Handbook of Research on the Global View of Open Access and Scholarly Communications

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A volume in the Advances in Knowledge Acquisition, Transfer, and Management (AKATM) Book Series

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entrance qualifications. The quality of education in Ethiopia is further impacted by their limited access to critical content or knowledge as evidenced by limited subscriptions to scientific and technical databases. In recognition of open access's (OA's) potential to fill disadvantageous access gaps and enhance the overall educational quality, Ethiopia adopted a National OA policy in 2019. Among other enforcement mechanisms and guidelines, the policy requires universities to deposit all publicly funded publications in the National Academic Digital Repository of Ethiopia as well as in an institutional repository. In this chapter, the authors outline the state of OA policies and practices in Ethiopia's higher learning institutions.

Chapter 3

Open access initiatives (OAI) have gained momentum and have been accepted by the academic communities of the world. The role of libraries in promoting open access culture in universities is much more crucial in many ways. In the present study, the university library system in Northeast India has been assessed about the OAI taken up by them. The same has enabled the authors to ascertain many clues of the university systems, services, facilities, establishment of institutional repositories, supporting open access publications, conducting advocacy programs, and many others as a sign of engagement in this movement. The findings of the study have shown that almost 90% of the university libraries of the region have supported the open access movement and some of the universities have also started to establish digital institutional repositories using DSpace software.

Chapter 4

Open access (OA) publishing has been in existence for almost 30 years. The development is not without barriers. So much effort has been needed to develop OA publishing, including OA books, OA repositories, OA journals, and open data repositories. Indonesia has been experiencing growth in OA publishing, especially in the last 10 years. To realize OA publishing requires much effort. Lack of understanding of OA, lack of OA policy, and contrasting views of OA have resulted in weak recognition of OA publishing. Further and more efforts are needed.

Chapter 5

This chapter explores scholarly communication practices and strategies in institutions of higher learning in Sub-Saharan Africa to increase visibility and reputation. For long, it has been acknowledged that foundations of institutions of higher learning rest upon creating and disseminating knowledge, which serves as an engine for scientific progression leading to a knowledge society. This is true despite scholarly communications receiving limited recognition from senior leadership at most institutions of learning. Visibility of institutions via scholarly communications is of high significance considering the inputs made by scholars and the applicability of study findings for perfecting routinized works or correcting faulty systems in departments, ministries, and agencies in nations. This is evident in developed countries

who furnish their scholarly communication offices with librarians to enhance the production and communication of knowledge. Strategies and practices of scholarly communications among institutions of higher learning are discussed.

Section 2
Embracing Open Access

Open access plays a significant role in accelerating scientific research. This was demonstrated particularly when researchers across the world were racing with time to combat the COVID-19 pandemic. The chapters in this section serve as an overarching framework through which the rationale or the need for open access can be argued, including issues and potential impacts, ranging from reducing misinformation or the spread of fake news on social networks to enhancing data quality, promoting research reproducibility, equity, and inclusion.

Reproducibility-enhancing practices of open access journals in biomedical sciences are investigated. Based on transparency and openness promotion guidelines and relevant reporting requirements by institutions that are in the forefront of advancing reproducibility research, eight standards were used to evaluate 27 biomedical journals to 1) determine the extent to which these journals address reproducibility, 2) identify specific policy themes required, and 3) understand overall infrastructure promoted by the journals to deposit, archive, share, and discover research assets. The results show that almost all the 27 journals required authors to address six of the eight standards when preparing and submitting their research. Two standards that were not frequently addressed are preregistration of the study and preregistration of analysis plans. 'Data availability' policy is the most recurring theme across all journals. The infrastructure promoted to manage the overall scholarly communication workflow range from data, code, software repositories, protocol registration, to funding registry.

When educators have difficulty accessing peer-reviewed research, it is inequitable to expect them to compete with educators who have access to a plethora of resources. Inequities have been a historically-identified educational problem; however, the forced online learning that occurred during COVID-19 restrictions amplified discrepancies experienced by tertiary educators. Scholars who were forced to work without strong information communication technologies infrastructure and who experienced limited access to online resources struggled more than those that had 24-hour uninhibited access. Education came to a near standstill for those that could not easily move their activities online. Prior to the pandemic, individuals working with curricula were already feeling handicapped by the lack of access. When physical libraries were closed, it became nearly impossible for many to move forward. This chapter explores the changing publishing paradigms, particularly the role of OA and how increasing open dissemination of scholarly outputs can reduce inequities in curricula and research activities.

Protection of personal information and access to universities' records requires the establishment of a records management division to handle personal information. Yet little attention has been focused on the roles and responsibilities of records management professionals, who enable the management of personal information. The purpose of this chapter is to assess and compare the current state of the implementation of the Protection of Personal Information Act No 4 of 2013 in two South African universities, namely the University of Venda and the University of Witwatersrand. The chapter used a qualitative research approach. Secondary data were derived from a literature search and primary data from interviews. Despite the enactment of the act, privacy breaches continued to increase due to the ineffective records management division dedicated to the management of personal information. Universities are to strengthen their internal process on personal information to comply with the General Data Protection Regulations (GDPR).

Academic research has traditionally been published under a subscription model with limited access and exposure. However, in recent years, open access (OA) has spawned a new research publishing economy. Journals have become more accessible in the research sector, with anybody able to see or access them for free on an internet platform. In certain research areas, the transition to openness has progressed more quickly than in others. Communication, education, and employment around the globe have become simpler as a result of the dynamic changes taking place online. Learning has become more equitable as a result of having access to information. Such uninhibited access has effectively opened the door to knowledge, educational resources, and a tremendous quantity of data. This material can be used for societal, educational, and scientific purposes. Given quick access, OA was a tremendously beneficial source for academics, scientists, and researchers during the COVID epidemic. This chapter covers issues related to open access, including OA ethics and OA strategies.

COVID-19 is an infectious disease of the newly discovered coronavirus (CoV). The importance and value of open access (OA) resources are critical in the context of the COVID-19 epidemic. OA aided in the development of a vaccine and informed public health actions necessary to stop the virus from spreading. Many publishers implicitly acknowledged that OA was vital to promote science in the fight against the disease. Accordingly, publishers have committed to OA publication and scholarly communication of

disease-related scientific research. This chapter covers three issues based on the modeling of the CoV dataset. First, an exploratory data analysis is done to detect the hidden facts and the relevant information patterns about the affected, recovered, death cases caused by the CoV and the vaccination details. Second, a predictive model is developed using machine learning techniques to effectively predict the number of COVID-19 positive cases in India. In the last step, a hybrid computational model is developed to identify the misconceptions that are spread through social media networks.

Since the early 21st century, the scholarly community has struggled with the rising cost of scientific publications and issues related to the accessibility and dissemination of scientific work and research results to the wider community. Maintaining a high quality of scientific publications and lowering the cost led to the emergence of the open access (OA) movement. OA has appeared as an essential resource to make scholarly publications available to a broader audience in the last two decades, aiming to improve access to scientific knowledge. However, the onset of the internet and social media has given rise to a tide of misinformation, resulting in diminishing trust in science. This chapter discusses the importance of OA as a trusted source in combating misinformation and adopting strategies for sustaining the OA business models. Additionally, this chapter draws on the social psychology literature and the "inoculation theory" to reason why OA as a credible source of information can protect us against misinformation.

The growth of open access (OA) journals has been rapid and substantial. While still not the predominant form of journal publishing, OA journals of varying types have impacted the scholarly communication ecosystem in a profound way. Libraries and librarians have been at the front lines of this effort from the beginning, working with researchers, funders, and institutional administrators to bring out substantive change to the unsustainable models of costly dissemination of research. After over 20 years of progress in both the transition from print to online, as well as opening access to read, how have OA resources fit in with academic libraries' collections? Are OA resources currently considered part of a library's collection? If not, will they ever be? More broadly, what has been the impact of the open access movement and OA resources on library collections, the concept of library collections, and the practice of collection development? How has the impact of OA on collections differed between libraries in the Global North vs. the Global South?

Section 3
Navigating the Open Access Ecosystem

In light of the evolving current academic and learning environments, this section consists of chapters that explore various publishing models and discuss the challenges and opportunities, including complex relationships between and among various stakeholders in the textbook and publishing industry as well as the library's critical role in navigating these landscapes.

Open access (OA) journals have transformed the academic publication to a different realm, which was unfathomable years ago. The early 1990s witnessed OA journals founded by individual scholars which are now in the hands of major publication players using them as another disruptive business model. The benefits of an OA system outweigh its disadvantages. Growth in accessibility, visibility, citations, and impact on research work are some of the promising outcomes of OA. Though it has been contemplated as an inevitable element in scholastic writing for a long time, there are many misconceptions loaded with open access. The present study aims to navigate into the perceptions of open access journals among researchers intriguing into the fine clauses established in the scholarly publication arena. The chapter also intends to examine the features of major publishing houses in a global perspectives and probe into the best practices of open access from different publishing houses in an effort to enhance the overall capacity of the open access and to create a knowledge-based economy.

Open educational resources (OER) has varying explanations, but its broadest definitions include materials offered freely and openly to use and adapt for teaching, learning, development, and research. An open educational resource must have an open license following the 5Rs: retain (make, own, and control your copy of the content), reuse (use the content as-is), revise (adapt, adjust, modify, improve, or alter the content), remix (combine the original or revised content with other OER to create something new), redistribute (share your copies of the original content, revisions or remixes with others). With such open educational content, one can learn from a growing pool of knowledge for free. In this chapter, the authors present the rationale behind the open educational resources (OER), types of OER, the key players, opportunities, and challenges adopting it, and the future scope.

Foreword

Handbook of Research on the Global View of Open Access and Scholarly Communications, edited by Daniel Gelaw Alemneh, is an amazing volume that will serve many communities well. This group of international authors turns the OA lens on a full range of important scholarly communication topics. The 18 chapters cover theory and history as well as ethics and strategies, timely issues and current trends. Chapters range from the broad to the detailed in scope.

As a CC-BY OER, the Library and Information Science community of instructors may take full advantage of it to mold it to their curriculum, enhance the quality of education, and improve student learning. LIS students, like the broader reading public, will find that it covers a wide range of well-known issues, including digitization is not enough, countering misinformation, implications of SARS Cov2—Covid 19 and the impact of limited access on critical content in the sciences and social sciences. It also presents less-considered topics such as personal information, citizenship participation, and computational models.

In this one volume readers have the opportunity to learn about OA in collection development and content management, in research reproducibility and misinformation, in publishing and sustainable business models. Here are international perspectives on OA journals including impact and visibility, accessibility, and publishing from funding models to DOAJ.

The Global View addresses OA and scholarly communication from not only from the diverse perspectives of the international authors but the diverse elements of the scholarly communication ecosystem. This volume doesn't just talk about inequities, it shows how to begin to fill the gap in curricula and research output by exploring scholarly communication practices and strategies in institutions of higher learning.

I found the multicultural perspectives enlightening for my western eyes. The Global View will prove to be a very informative for the novice and those new to the field of scholarly communication as well as to well-read and veteran librarians. It will appeal to practitioners and stakeholders alike, in addition to teacher and student.

In designing *Handbook of Research on the Global View of Open Access and Scholarly Communications*, Alemneh has successfully brought together diverse perspectives to meet the needs of a diverse audience. While the Global North is represented, emphasis is on the Global South, which should prove informative to all readers. He has created a work that will for a long time serve the increasing diversity of readers because he brought to the work many global perspectives on a full range of scholarly communication and open access topics.

Gail McMillan
University Libraries, Virginia Tech, USA

Preface

We live in a society where information and knowledge are key ingredients of social, economic, cultural, and political activities. General progressive changes in society reflective of the current trends and realities in the 21st century, include the transformation of scholarly communication. Equitable and fair access to information and knowledge is paramount.

The Open Access (OA) movement has continually evolved over the last couple decades, starting as a scholarly communication concern and expanding to include issues integral to the social justice movement, opportunity, inclusion, equity, and human rights. At its core, OA addresses many inequities and can potentially contribute to broad and inclusive scientific progress. Whether that is the actual case or the extent to which development and strategies are still progressing can only be determined through a comprehensive assessment of the state of OA globally. This book is an attempt at such an appraisal and to complement the growing body of literature surrounding OA.

The book aims to provide a detailed analysis of OA and scholarly communication from diverse global perspectives. The vision driving this book was to develop action-oriented, impact-driven, and socially relevant outcomes through advocacy and increasing adoption of OA modes of publication. The book includes detailed discussion regarding OA publishing, equity and the democratization of knowledge, and how open access publishing is transforming scholarly communications in general. In particular, the contributors examined various initiatives to advance OA publishing at the global level. Specifically, the chapters scrutinized how higher education institutions and educators currently advance OA models and OA publishing.

The chapters have an international focus and provide guidance, lessons learned, and best practices meant to foster sustainable global publishing. This collection represents effective case studies from experiences in developing and developed countries, including diverse socio-economic settings from around the world. Discussion also includes how national and international legislations and policies are helping craft and promote the democratization of data, information, and knowledge in the United States, the European Union, and countries in Africa and Asia.

This compilation will not only help enhance understanding of diverse issues associated with OA but also serve as a compendious volume providing educators a textbook that can be used to cover foundational knowledge in areas of OA and scholarly communications in general. Due to the continual transformation in scholarly communication, this edited collection is of value also to higher education leaders, information science researchers, publishers, and scholars aspiring for research outputs to have greater impact on people's everyday lives.

The authors have been educating students, faculty, and communities about OA for the past two decades. They have shared their work products, ideas, and projects, regarding OA at conferences, in classrooms, and

in cultural heritage institutions. The ongoing research and work in this area together with strong beliefs in the benefits, in equity, in social justice, all offer a conceptual frame for the book. Even though many of the authors are from North America, they have international ties and experiences and understand the deep need for OA as a global initiative. Moreover, the examples of North American, European, African, and Asian case studies provide exemplar ways of OA implementation in general, identifying significant directions to pursue and practice around the world. Despite the differences, the framework of analysis in terms of community contexts, challenges, opportunities, strategic actions, desired outcomes, and impacts should be of interest to researchers and academics working around the globe.

ORGANIZATION

For this book, we received 62 strong proposals that explored OA from diverse points of views. We selected 18 chapters from 40 authors from Brazil, Ethiopia, France, India, Indonesia, Namibia, Nigeria, South Africa, and USA.

Based on the final compilation of the chapters, the book is divided into three sections or thematic headings:

- Open Access Initiatives and Scholarly Communication Practices
- Embracing Open Access
- Navigating the Open Access Ecosystem

Section 1 focuses on "OA Initiatives and Scholarly Communication Practices" in various settings. This section focuses on OA enterprises and strategies in various contexts, telling of the current state and practices in specific disciplines or geopolitical regions. It consists of the following five chapters:

Chapter 1 focuses on the processes that underpin the production of Open Science by examining the development of open access scholarly publishing in Europe, particularly for the social sciences and humanities. Among other issues, the COVID -19 crisis, and the spread of fake news on social networks have shown how necessary it has become to provide scientific information that is controlled by the community and freely accessible to citizens.

Chapter 2 shares the endeavours and experiences of Ethiopia, which adopted a National OA policy in 2019. Among other enforcement mechanisms and guidelines, the policy requires universities to deposit all publicly funded publications in the National Academic Digital Repository of Ethiopia as well as in an institutional repository. This chapter also outlines the state of OA policies and practices in Ethiopia's higher learning institutions.

Chapter 3 explores the role of libraries in promoting open access culture in the university library system in Northeast India. The enablers include, services, facilities, establishment of institutional repositories, supporting open access publications, conducting advocacy programs, and many others as a sign of engagement in this movement. The findings of the study show that almost 90% of the university libraries of the region support the open access movement.

Chapter 4 discusses how OA journals have developed well in Indonesia while the production of OA books still needs further investigation. It is expected that OA will have a wider readership, however, attention from institutions, policy makers and the government are still needed. Lack of understanding of OA and its implementation result in poor accessibility to research and other resource outputs from

institutions in Indonesia. The chapter recommends programs to develop the understanding of OA, including OA as coursework in the LIS department.

Chapter 5 explores scholarly communication practices and strategies in institutions of higher learning in Sub-Saharan Africa. This chapter argues to increase visibility and reputation of institutions of higher learning, their mission and vision should include production and dissemination of knowledge either through formal or informal channels.

Section 2 concerns concepts related to "Embracing Open Access" and highlights the facts that open access plays a significant role in accelerating scientific research in general. This was demonstrated particularly when researchers across the world were racing with time to combat the COVID-19 pandemic. The chapters in this section serve as an overarching framework through which the rationale or the need for open access can be argued, including issues and potential impacts, ranging from reducing misinformation or the spread of fake news on social networks, to enhancing data quality, promoting research reproducibility, equity, and inclusion. This section includes the following six chapters:

Chapter 6 introduces reproducibility, which refers to the ability of a researcher to duplicate the results of a prior study using the same materials as the original investigator. Based on eight standards, this chapter reports the evaluation of 27 open access biomedical journals, with the aim to: 1) determine the extent to which these journals address reproducibility, 2) identify specific policy themes required, and 3) understand overall infrastructure promoted by the journals to deposit, archive, share, and discover research assets. The results show that almost all the 27 journals required authors to address six of the eight standards when preparing and submitting their research. The infrastructure promoted to manage the overall scholarly communication workflow range from data, code, software repositories, protocol registration, to funding registry.

Chapter 7 explores the changing publishing paradigms, particularly the role of OA and how increasing open dissemination of scholarly outputs can reduce inequities in research curriculum design during higher education activities and even more so during a worldwide pandemic forcing learning and research to be conducted almost entirely online. A link between OA and social justice is introduced.

Chapter 8 assesses and compares the current state of the implementation of the Protection of Personal Information Act No 4 of 2013 in two South African universities, (the University of Venda and the University of Witwatersrand). The chapter used a qualitative research approach. Secondary data were derived from a literature search and primary data from interviews. Despite the enactment of the Act, privacy breaches continued to increase due to the ineffective records management division dedicated to the management of personal information. Universities are to strengthen their internal processes on personal information to comply with the General Data Protection Regulations (GDPR).

Chapter 9 covers issues related to evolving Open Access, including OA Ethics and OA Strategies. Learning has become more equitable as a result of having access to information. Such uninhibited access has effectively opened the door to knowledge, educational resources, and a tremendous quantity of data. This material can be used for societal, educational, and scientific purposes. Given quick access, OA was a tremendously beneficial source for academics, scientists, and researchers during the COVID-19 epidemic. Although open access creates a new research publishing economy, the transition to openness has not progressed quickly in some disciplines.

Chapter 10 highlights the importance and value of open access resources in the context of the COVID-19 epidemic. OA aided in the development of a vaccine and informed public health actions necessary to stop the virus from spreading. This chapter covers three important issues based on the modeling of the CoV dataset. First, an Exploratory Data Analysis is done to detect the hidden facts and the relevant

information patterns about the affected, recovered, and deaths caused by the CoV and the vaccination details. Second, a predictive model was developed using machine learning techniques to effectively predict the number of COVID-19 positive cases in India. In the last step, a hybrid computational model is developed to identify the misconceptions that are spread through social media networks.

Chapter 11 discusses the importance of OA not just to improve access to scientific knowledge, but as a trusted source in combating misinformation and adopting strategies for sustaining OA business models. Considering the rise to a tide of misinformation (resulting in diminishing trust in science), this chapter also draws on the social psychology literature and the "inoculation theory" to reason why OA as a credible source of information can protect us against misinformation.

Section 3 is on "Navigating the Open Access Ecosystem." In light of the evolving current academic and learning environments, this section consists of seven chapters that explore various publishing models and discuss the challenges and opportunities, including complex relationships between and among various stakeholders in the textbook and publishing industry as well as the library's critical role in navigating these landscapes.

Chapter 12 elaborates the practice of Open Access, which was originally proposed as a solution to the problem of hyper-inflated subscription prices to scholarly journals. While much of the attention to this problem was brought forward by academic librarians in the Western world, the pinch was felt even more acutely by library managers in the Global South. In fact, the original Budapest Open Access Initiative included "share the learning of the rich with the poor and the poor with the rich" as one of the key outcomes of "reducing access barriers", to reduce global economic inequities. While the OA movement has made substantial changes to the roles filled and services provided by librarians supporting OA publishing efforts, the focus of this chapter will be on the impact of OA on library collections and how expanded access is valued by collection managers, with an emphasis on libraries in the Global South.

Chapter 13 examines the features of major publishing houses from a global perspectives and probes into the best practices of open access to enhance the overall capacity of open access and to create a knowledge-based economy. It navigates the perceptions of OA journals among researchers established in the scholarly publication arena. Though open access has been contemplated as an inevitable element in scholastic writing for a long time, there are many misconceptions loaded with it, as some players use them as another disruptive business model.

In Chapter 14, the authors present the rationale behind Open Educational Resources (OER), which are defined as "materials offered freely and openly to use and adapt for teaching, learning, development, and research." The chapter highlights the 5Rs (Retain, Reuse, Revise, Remix, and Redistribute), together with the types of OER, the key players, opportunities, challenges adopting these resources, and the future scope.

Chapter 15 shares the relevance of the use of plain language by local and federal governments to enable easy access, inclusion, and citizenship participation. The researchers conducted action research supported by the Toyota Kata approach demonstrating how the change in the semantical construct in the forms and service description is significantly altered post digitalization of some services provided by the State of Santa Catarina Government. The results demonstrate that plain language impacts the comprehension and consumption of information, incurring in more inclusive e-government services.

Chapter 16 addresses the various issues associated with open access publishing as a business model with distinct opportunities. The chapter throws light on Article Processing Charges (APC), the relevance of impact factors, citations, and pricing. The complexities researchers confront, and the rise of predatory journals and their concerns are discussed in detail. The ethical dimensions of publishing and the

role and relevance of the Committee on Publication Ethics (COPE), among the diverse stakeholders, is also explored.

Chapter 17 portrays the experience of the COVID-19 pandemic, which drastically forced millions into a digital world of the unknown. The unexpected perplexities of these unknown digital environments resulted in unacceptable percentages of student losses in school attendance and academic performance. The chapter further speculates that educational institutions will have to rely upon remote, digital interfaces due to possible future challenges. Despite the barriers, new opportunities to learn and provide access to products and services emerged such as creating open knowledge bases for future challenges; openly accessible MiFi, WiFi, and other hardware; and other OA opportunities.

Chapter 18 provides insight into the discursive terrain of the Open Access phenomenon and positions the processual as well as the discourse communities that Open Access is inevitably enmeshed in. The chapter explores the current climate of Open Access and investigates the ethical dilemmas. Further, the essay also recommends a viable model that can be deployed by State players as an exemplar of academic socialism that is flexible, accommodative, and a true reflection of the open-access philosophy which also counters the development of otherwise illegal and 'pirate' models of Open Access.

On a final note, the authors of this book are to be commended for having carefully and accurately written their chapters based on the theme of the book. Thanks to IGI Global's OA (Read & Publish) Initiative, having this book published in the same modality it is promoting (under platinum OA freely) provides research on how to navigate OA and scholarly communications issues in general. Moreover, such transformative institutions/publishers' partnerships indeed help to support the OA movement and provide innovative solutions that will benefit all stakeholders. Offering this book globally as OA allows each author to memorialize their advocacy for OA, share their success stories that may benefit others, and convey a clear message about where OA is headed, all to an international audience.

Considering the wide range of topics discussed in the book and the ease of obtaining a digital copy, I hope that you will find the individual chapters, as well as the book as a whole, a valuable source of information for your future research and scholarship.

Daniel Gelaw Alemneh
University of North Texas, USA

Acknowledgment

For the glory of God alone!

The editor would like to acknowledge the help of all the people involved in this project and, more specifically, to the authors and reviewers that took part in the review process. Without their support, this book would not have become a reality. My sincere gratitude goes to the chapter authors who contributed their time and expertise. Special thanks go to the editorial advisory board members and reviewers who worked around the clock during the blind review process to ensure the quality of every chapter accepted for publication in this volume. Some of them are world-leading researchers and OA proponents and have also contributed chapters and endorsements for this book. In particular, I highly appreciate the double tasks performed by Professors Abebe Rorissa, Samantha Hastings, Gail McMillan, Ina Fourie, and Angela Ford. I am also very grateful for my colleagues at the University of North Texas who unanimously endorsed this book for Diamond OA. I would also like to thank the Fulbright Scholar Program, sponsored by the Bureau of Educational Cultural Affairs of the US Department of State, for the amazing opportunities to serve as a Fulbright Scholar. This book has benefited from the professional network developed as well as from the invaluable experiences gained from my Fulbright services both in Ethiopia during the eventful 2019-2020 academic year, as well as in South Africa 2021-2022. Last but not least, I thank IGI Global's editorial and production team who continuously supported my work. It's an honor to be one of the first to publish under the new IGI's Diamond/Platinum Open Access (Read & Publish) Initiative, which allows us to practice what we preach. Due to such new creative and sustainable business models that are continuously manifesting, the future outlook for the OA movement is bright.

Daniel Gelaw Alemneh
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Section 1

Open Access Initiatives and Scholarly Communication Practices

This section focuses on various OA initiatives in various settings – telling of the current state and practices in specific disciplines or geopolitical regions.

Chapter 1
From Open Access Publishing to Open Science:
An Overview of the Last Developments in Europe and in France

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ABSTRACT

By facilitating and accelerating access to knowledge, the digital revolution and the development of the internet in the 1990s constituted a "disruptive" innovation that radically transformed the models and practices of scientific information transmission. It opened the way to open access in science, a novel and promising solution that promotes the sharing of publications and data, and new modes of research assessment. The COVID-19 crisis and the spread of fake news on social networks have shown how necessary it has become to provide scientific information that is controlled by the community and freely accessible to citizens. This chapter will focus on the processes that underpin the production of Open Science by examining the development of open access scholarly publishing in Europe, particularly for the social sciences and humanities.

INTRODUCTION

Open Access to the results of scientific research brings promising and democratic solutions to enlighten citizens. It may contribute to upgrade the quality of scientific information and to raise the level of acceptance of common scientific representations amongst the population. However, this is far from being systematic: in the same time when huge scientific progress enabled the making of a vaccine to resist the virus, the Covid-19 pandemic generated unprecedented amounts of pseudo-scientific information on the web, distilling doubt in scientific discoveries and putting in danger the health of the world's population. It is becoming urgent to realize how Open Science models could help solve such a contradiction. Therefore,

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this chapter will focus on the processes that are at the roots of producing Open Science through reviewing the development of Open Access publishing in Europe, especially for Social Sciences and Humanities.

OPEN ACCESS PUBLISHING, A POLYSEMIC NOTION

Open Access appears to be a powerful incubator for the scientific community to gain autonomy by developing new scientific dissemination and publication practices, and also by allowing the sharing of a wide variety of often unknown data and works. Usually these scientific products are not published in journals or books, such as field notebooks, databases, open source tools, software, etc. They are commonly grouped under the concept of "bibliodiversity". Sharing them through data interoperability protocols creates a new ecosystem that paves the way for reproducible science without financial barriers or restrictive copyrights. At the same time, it undermines the traditional systems of disseminating work via scientific journals published by large commercial publishers.

Physicists were the initiators of this movement with the launch of the first open archive site, ArXiv, in the early 1990s, offering unprecedented and free access to the discipline's work. Subsequently, many countries and institutions have spontaneously developed open archive repositories in all disciplines to encourage scientists to self-archive their scientific work in order to promote free and rapid access to it. This model has been characterized as "green Open Access" by the Budapest Open Access Initiative (BOAI, 2002). The date of publication of results in an open archive allows for better security against plagiarism. It marks a new step in strengthening scientific integrity. Indeed, the deposit guarantees the copyright of the author.

Considering the rapid inflation of open archive sites, a collaborative European project between the University of Nottingham (UK) and Lund University (Sweden) began in 2005 to identify these directories, classified by country, institution and discipline. From just over 900 in 2008, there is now nearly 6,000 as of 2021. Europe also deployed successive census sites such as Driver with the objective to organise and build a virtual, European scale network of existing institutional repositories from the Netherlands, the United Kingdom, Germany, France, and Belgium. In 2009, OpenAire succeeded to Driver. "The Project aim was to support the implementation of Open Access in Europe. It provided the means to promote and realize the widespread adoption of the Open Access Policy, as set out by the ERC Scientific Council" (OpenAire).

With the advent of the Internet, the scientific community is also committed to the development of alternative models of independent scientific journals (Kosmopoulos, 2002), without subscription, at no cost either to the reader or to the author. In 2002, the Budapest Open Access Initiative marked Open Access journals with the color gold and grouped them under the heading "gold Open Access".

Since the launch of the Internet in the 1990s, these two models of Open Access in scientific publishing - "green Open Access" and "gold Open Access" - have coexisted while following different and even contradictory dynamics. For the record, in the early 2000s, "Open Access (OA) literature is digital, online, free of charge, and free of most copyright and licensing restrictions. Open Access removes price barriers (subscriptions, licensing fees, pay-per-view fees) and permission barriers (most copyright and licensing restrictions) (….) In addition to removing access barriers, Open Access should be immediate, rather than delayed, and should apply to full texts, not just abstracts or summaries" (Suber, 2004).

The Directory of Open Access Journals (DOAJ), created in 2003, accounted for more than 3,000 journals in 2008 and more than 10,000 in 2020. However, in 2020, the DOAJ included journals whose

Open Access model moved away from the original BOAI definition of "gold Open Access". During these same years, commercial publishers invested massively in the digitization of their paper journals and created new subscription packages of digitized journals. From when the initiative was announced until 2012, the extension of Open Access to scientific publications badly threatened the financial interests of commercial publishers such as Elsevier (Kassab, 2015), Taylor & Francis, Springer etc. It led them to rethink their classical models of publication and their subscription policies. Unable to stop this emancipation movement, they have recovered by appropriating the "golden way" model and diverting it from its initial objective by introducing fees called Articles Processing Charges (APC).

These adaptations to the emerging models of Open Access on the part of traditional commercial publishers have led to the evolution of Open Access journal models in different colors and textures. They are now available not only in green, gold, but also in hybrid (subscription and APC), diamond, platinum, delayed Open Access with embargo etc. (Flamerie, 2015) imposing huge costs on taxpayers and citizens, knowing that these benefits do not go back to research. In the end, Open Access became a real growth opportunity for the scientific publishing industry (Kassab, 2021). A profound reorganization of the entire scientific publishing industry is underway, including new models for Open Access books such as "bronze" and "black" (Barnes, 2018). More generally the term Open Data should cover all types of Open Access productions of different colors including publications (Schuhl, 2020). The recent "transformative agreements"[1] establishing APC subscriptions for research Institutions and Universities aim to compensate for the progressive loss of subscriptions to journal packages by the scholarly libraries (Kassab, 2021). In Europe this formula resonated with a number of European countries who launched in 2014 the Efficiency and Standards for Article Charges Initiative (ESAC Initiative, 2014) following up on the 2013 international symposium organized by the Max Planck Digital Library and sponsored among others by Elsevier and Thomson Reuters.

The "gold" Open Access, the APC-based business model, is now well established in hard sciences and has begun to reach Social Sciences and the Humanities (SSH), notably via co-publications. "A whole system has been designed to force researchers to let their work be exploited for the benefit of certain publishers: the latter organize the dissemination of scientific information, whose reliability they guarantee thanks to evaluations (in principle unpaid) carried out by researchers. They charge authors and users for their services via journal subscriptions or APC, while proposing bibliometric measures intended for institutions that evaluate the production and regulate the researchers' careers. Thus, quantitative evaluation scoring, measures based on reputation (altmetrics), or "professional" social networks, etc. have been set up to complete the system around these private distribution monopolies. They tend to impose a mode of operation on research that makes them necessary, while not offering the tools that would be best suited to understand the real impact and stakes of research. Numerical indicators alone lead to confusing data with the qualitative information, to relegate the meaning of research results to numbers with little meaning". At the end, "the taxpayer pays huge subscriptions to major publishers to obtain bibliometric indicators on the productions they distribute, which are required in many countries for the granting of funding and career advancement of researchers, who are nevertheless the producers and volunteer evaluators of this research carried out on public funds" (Kosmopoulos & Pumain, 2018).

In fact, the impact factor of journals created by E. Garfield was a documentary tool that aimed to guarantee selected quality journals by studying the number of citations in the bibliographic references produced by researchers (Garfield, 1963). He rightly thought that indexing by non-specialist librarians was not adapted to scientific research, particularly in medical sciences, whereas bibliographic citations produced by researchers in their publications could facilitate documentary research. Well before the

Internet, it allowed researchers via the Current Contents to keep informed of research and publications in their fields, and to avoid the repetition of similar scientific works.

With the explosion of bibliometric tools since the 2000s and the confiscation by commercial publishers of scientific evaluation based on opaque and scientifically unproven data, Open Access opens up new and transparent perspectives that better account for the richness and specificity of scientific productions according to disciplines and allows for a more qualitative analysis using text mining and semantic analysis methods. The San Francisco Declaration on Research Assessment[2] expresses the need for research assessment "to eliminate the use of journal-based metrics, such as Journal Impact Factors, in funding, appointment, and promotion considerations". It recommends " to assess research on its own merits rather than on the basis of the journal in which the research is published" and to "consider the value and impact of all research outputs (including datasets and software) in addition to research publications, and consider a broad range of impact measures including qualitative indicators of research impact"(DORA, 2013). It also meets the ten principles on research assessment of the Manifesto of Leiden, The Netherlands (Hicks et al., 2015).

Indeed, Open Access journals have not modified the landscape of the scholarly communication alone. Open archives repositories opened the way to various content such as media, research notebooks, preprint, data, software etc., based on Open Access technologies. The protocols for interoperability and the exchange formats are the keys of data and metadata exchange. The interoperability of open data combined with such digital bibliodiversity offers new perspectives for statistical analyses that are broader and finer than bibliometric indicators and the impact factor (Kosmopoulos, 2015) within the web 2.0 environment. Documentary tools must above all serve the advancement of science[3]. The bibliodiversity available on self-archiving sites combined with Text and Data Mining tools appears to be a means of widening the scope of evaluation to all the productions of scientific research and to go beyond the impact factor.

FROM OPEN ACCESS TO OPEN SCIENCE IN EUROPE

Various European institutions have succeeded in paving the way for a wider acceptance of Open Access principles. This section recalls the stages of institutional construction in Europe of its Open Access model. It shows the convergence of the efforts of several institutions (the Commission, the research programs, the ERC). It also specifies in a concrete and technical way the means that have been implemented to satisfy all the actors and bring them to change. It will also show how some European countries have gone further than others.

Previously named "Science 2.0" in reference to web 2.0, the notion of "Open Science" was introduced by the European Commission in the early 2010s. "As other challenges need to be addressed such as infrastructure, intellectual property rights, content-mining and alternative metrics, but also inter-institutional, inter-disciplinary and international collaboration among all actors in research and innovation, the European Commission is now moving decisively from 'Open Access' into the broader picture of 'Open Science'" (European Commission, 2014). Open Science is an extension of the Open Access movement, which it now encompasses. Favored by the digital revolution and the advent of the Internet, Open Access consisted of a movement to emancipate the scientific community and university libraries from the growing monopolies of private publishers (Swartz, 2008). Despite that Open Access means lower costs for the scientific community compared to the prices commercial editors charge to scholarly libraries and institutions, it also provides real benefits in terms of visibility and impact for the scholarly

information through its widespread interoperable dissemination and social networking (Eysenbach, 2006; Harnad & Brody, 2004) and therefore also in economic terms.

The European Commission has been in favor of Open Access for scientific publications and data since 2007: "To improve current and future access to scientific information, the European Union (EU) will support experiments with Open Access in its recently-launched research program (by, for example, refunding the project costs of Open Access publishing)". It also emphasizes the need to improve interoperability (European Commission, 2007). The prestigious Scientific Council of the European Research Council (ERC) advocated at the same time that a "free and efficient access to information, including scientific publications and original data, will be the key for sustained progress" (ERC Scientific Council Guide Lines for Open Access, 2007). The Seventh Research Framework Programme (2007-2012) of the European Union encourages the Open Access initiative: it develops policies mandating the deposit of scientific publications in an Open Access repository. In that case, the author is advised to deposit his or her final peer-reviewed manuscript (not the pre-print) after a certain embargo period, established in order to allow publishers to recoup their investment. The initiative covers approximately 20% of the budget of the Seventh Research Framework Programme, and applies to 7 areas, including Social Sciences and Humanities. In addition to funding programs like OpenAire, the European Commission made a visible commitment to Open Access in 2008 by launching Driver: The Networking European Scientific Repository, combining self-archives repositories from many different European countries, institutions and disciplines.

On 17th July 2012, the European Commission put forward a recommendation on access to and preservation of scientific information. Based on the assumption that access to publicly funded research is "speeding up scientific progress", this text advocates that such research should be disseminated "as soon as possible, preferably immediately, and in any case no later than 6 months after the date of publication, and 12 months for Social Sciences and Humanities" (Art.1). Four years later, on 17th May 2016, the Council of the European Union recommended rolling out this model to all Member States in order to make Open Access a "default option by 2020" (Langlais, 2016).

Considering that "although Europe generates more scientific output than any other region in the world, in some areas we fall behind on the very best science. At the same time, there is a revolution happening in the way science works. Every part of the scientific method is becoming an open, collaborative and participative process" (Moedas, 2015). The European Commissioner for Research, Science and Innovation, Carlos Moedas, defines three priorities for his action: "Open Innovation, Open Science, Openness to the World". "Open Science describes the on-going transitions in the way research is performed, researchers collaborate, knowledge is shared, and science is organized. It is driven by digital technologies, the globalization of the scientific community, and the need to address grand societal challenges" (European Commission, 2017, p. 16).

Driven by Science Europe[4] and on the initiative of the European Commission, the cOAlition S[5] launched a public debate on the issue of Open Access that led to the writing of the Plan S (2018). Built on the basis of ten principles, the Plan S requests from the scientists and researchers receiving public funding for their projects that they deposit their work by 2020 in Open Access journals or on open archive repositories. Although the Plan S excludes the hybrid journal model, whose cost to libraries and institutions appears to be uncontrollable, it includes in its principles the payment of APCs. It also addresses the issue of copyright and takes a position in favor of publications under the CC-BY license such as Creative Commons 4.0 (Creative Commons), which reinforces the inalienable rights of scientific authors. The Plan S led by Science Europe seems to offer a compromise with commercial publishers.

"However, to date, a lack of clarity has existed around our understanding of the extent to which publishers are responding to the Open Access policies of governments, funders and institutions to enable researchers to openly access and share their journal articles… In summer 2020 a research study was conducted in order "to explore copyright and licensing practices amongst the most prominent journal publishers in Europe and amongst European DOAJ journals" (Morrison et al., 2020). The study demonstrates that using CC BY or having zero-month embargoes or short embargoes for self-archiving, is far from being generally adopted by the scientific publishers. The report is accompanied by several recommendations for fostering the application of the Open Access licenses.

For many researchers in Europe, Plan S does not go far enough. They do not hesitate to openly call out Elsevier's "anti-competitive" practices by referring the matter to the European Commission's Directorate General (Des chercheurs dénoncent les pratiques "anticoncurrentielles" d'Elsevier, 2018). On the other side, logically, publishers' associations and commercial scientific publishing companies are speaking out against this Plan that seems to threaten their interests. Supported by at least 1,700 European researchers in Europe an Open Letter (November 28, 2018) is addressed to the EU against Plan S (Reaction of Researchers to Plan S, 2018). In France, a tribune in Le Monde (« Publications scientifiques », 2018) was published against this same plan, without avoiding some confusion in front of the complexity of the different Open Access models. On July 20, 2020, the European Research Council (ERC), which joined the cOAlition S at its creation in 2018, announced its withdrawal, notably because of the exclusion of publications in hybrid journals, which would harm the careers of young researchers (ERC, 2020). For several European countries as well, this exclusion is not realistic; it would lead to the disappearance of a majority of journals that currently operate according to this hybrid model. The French Mathematical Society reminded that the implementation of Open Science should not be done at any price and warns against the perverse effects of the author-pays system[6] (Société Mathématique de France, 2018).

However, the hybrid formula, which is very advantageous for private publishers, considerably increases the financial burden of libraries and institutions. It is often said that they ultimately pay three times: 1. the article of which work is publicly funded, 2. the subscription and, 3. the APC. For Jean-Yves Mérindol, "the emergence of hybrid journals blurs the traditional boundaries between research and documentation expenses" (Mérindol, 2020), which leads to the reorganization of budgets and the beginning of new negotiations in an area where the greatest opacity resides. OpenAPC operated by Bielefeld University Library displays interesting information on payments to commercial publishers, although it is limited to information provided by research institutions. In France, the Couperin Consortium, in charge of negotiations with publishers, reported in more than 5 million euros spent in 2017 by 61 institutions for the publication of 2,927 articles (OpenAPC, 2017). These APCs come in addition to subscriptions to journal packages and access to bibliometric databases (Elsevier's Scopus, Clarivate's WOS), the costs of which are negotiated and not made public (Kosmopoulos, 2019). Like journal subscriptions, remunerations for transformative agreements are made within the national, not European, framework. They vary across publishers, countries, and institutions, yet the amounts are not known and therefore not comparable.

Since 2008, the European Union has deployed successive census sites such as Driver or OpenAire to promote access to Open Access documents according to the protocol of interoperability. Simultaneously in partnership with CERN, UE launched in 2013 its own European self-archiving platform named Zenodo. At the end of the 2000s, OpenAire Explore provided access to more than 120 million Open Access publications and 856K datasets interlinked with publications. The issue of open data in compliance with FAIR principles (Wilkinson et al, 2016), which are either deposited on dedicated repositories such as Zenodo with a Digital object identifier (DOI), or associated with "data papers" whose publication

is validated by peers like any scientific article, is emerging as an economic necessity for the Commission. In its 2018 report, the Commission concluded that "research expenditures in Europe amounted to €302.9bn in 2016. While the minimum true cost of not having FAIR can be seen as only 3% of all research expenditures, €10.2bn per year is 78% of the Horizon 2020 budget per year and ~ 400%, of what the European Research Council and European research infrastructures receive combined. To top this, figures for the open data economy suggest that the impact on innovation of FAIR could add another €16bn to the minimum cost we estimated" (European Commission. Directorate General for Research and Innovation. & PwC EU Services., 2018).

In 2014, the European Research Council (ERC) created an Expert Group on Monitoring and Evaluation of funded scientific programs to establish performance indicators adapted to the new context of shared data and Open Access. A report on quantitative performance evaluation in SSH (Kosmopoulos, 2015) describes the special status of SSH and the variety of its scientific productions which are not mainly journal articles. It helped to map out the practices of scientific evaluation, the problems encountered with bibliometrics or social altmetrics, and claimed a new generation of metrics applied to the bibliodiversity combined with peer review. The new Framework research program Horizon Europe is precisely accompanied by the deployment of a constellation of scholarly publication services dedicated to bibliodiversity, control and discovery (OpenAire Nexus) with the goal to integrate those services into the European Open Science Cloud (EOSC)[7].

The National Policies: The Example of France

The commitment to Open Science set out in the Horizon Europe framework program (2021-2027), along with the recommendations of the funding agencies grouped together in cOAlization S, is referred to the national actions of each European country. These actions must not only be in line with the legal framework of the country, but also consider the economic stakes that this change implies for all the actors of scientific publishing, public, private, and learned societies. Beyond the European research framework program Horizon Europe, some countries are going further. This is the case of France. According to the largest national research institution, the French National Centre for Scientific Research (CNRS), "France must conform to the values and rules emerging in supranational and foreign bodies and legislation, otherwise French science risks being marginalized. Among other things, Open Science must ensure protected authors' rights, common ethical rules, adapt to the different practices of scientific communities, etc." (Direction de l'Information Scientifique et Technique - CNRS, 2016).

Following a national consultation (2015-2016), the Law on Digital, in accordance with European recommendations, was enacted in 2016[8]. It defines the conditions of dissemination of a number of works of researchers funded by public funds. The obligation is to load one's articles on a self-archiving repository within a minimum of six months and within a maximum of 12 months for articles in SSH. The debates were lively in the media (Collectif, 2016) but also against the CNRS and its Institute of Human and Social Sciences (INSHS). Described as "mortifying" by some people, this law would, according to them, confiscate the rights of researchers to have their work and the quality label provided by private publishers. Moreover, the obligation to load in open archives repository could lead to state control of scientific publications (Valluy, 2017). There is also for a part of the journals in SSH, the fear of their programmed disappearance. Indeed, some of them only survive because of their paper subscriptions and have yet to switch to digital.

A Monitoring Committee for Publishing was set up in France in 2017 by the Ministry of Higher Education, Research and Innovation (MESRI)[9]. It brought together private and public actors involved in scientific publishing. Its objective was to measure in a concerted manner the effects of the digital law (2016) on the economics of publishing and to provide support for an evolution towards a genuinely Open Access model with licenses with a minimum of restrictions. Starting from the observation that "since 2016, because of the law but also because the mandatory filling is one of the criteria for the evaluation of laboratories, attention has been focused on the filling of articles in open archives, even though "the continuous decrease in subscriptions reflected a structural crisis in scientific publishing and a real danger of atrophy of the French publishing fabric" (Renoult D. (Comité de suivi pour l'édition scientifique), 2019, p. 3), a support plan for journals of 16.4 M€ for the period 2017-2021 is committed[10].

However, many questions still remained: what would be the real cost of moving to Open Access for journals operating on old models? (« Publications scientifiques », 2018); How do we avoid the monopolization by APCs of research budgets at the expense of open archive sites? Where does the privatization by commercial publishers of open archive and research data repositories take us? etc. As an example, the purchase in 2017 by Elsevier (RELX Group) of the open archive platform Bepress (Berkeley Electronic Press), created in 1999 by two American academics, for an estimated amount of 100 million euros, was indeed not reassuring about the future of "green Open Access".

At the same time, the agreement between Elsevier and the French national consortium of scholarly libraries Couperin[11], in charge of the renewal of a national license for journal subscriptions, was controversial. The agreement provided for a price cut of nearly 13% over 4 years, with a 25% discount on APCs and a compensatory clause if the APC price increase threshold was exceeded, limited to 3.5%. In addition, it provided the possibility of automatic access after 12 months to the "accepted author manuscript" (AMA) or postprinted in streaming directly on Sciencedirect, the Elsevier platform, as well as a record in the national open archive HAL of the CCSD (MESRI, 2019) that should point to this streaming. After 24 months, the pdf file of this manuscript would be directly uploaded on HAL[12], thus curtailing the embargo periods written in the law on digital technology and the principles stated in Plan S. The reactions came quickly, rejecting the Couperin/Elsevier agreement in principle and new proposals for a more democratic and transparent procedure for negotiations with publishers (Bulletin des bibliothèques de France, 2019).

The argument that APCs favors "predatory publishers" through Open Access journals based on publication fees (Ajones, 2017) works to the disadvantage of this model. In practice, the predatory publishers are start-ups (mainly from China, India but also Africa) that adopt journal names close to the names of renowned journals to create confusion. They charge APCs and publish the articles with very light and rapid scientific validation. Jeffrey Beall's list of potentially predatory journals and publishers in Open Access served as a benchmark until its removal in 2017. In 2014 more than 3000 fraudulent publishers were identified by Beall for nearly 10,000 journals (Shen & Björk, 2015). It has become increasingly difficult to distinguish legitimate journals from illegitimate journals using the APC model. A new research front is emerging that aims to define predatory journals and shed light on the risks that the gold APC-based business model poses to Open Access research (Boukacem-Zeghmouri & et al, 2020).

However, for Minister Frédérique Vidal, if "the time has come to invent a new world, where the free circulation of knowledge will become the norm..." and for France to commit "so that the results of scientific research are open to all, researchers, companies and citizens, without hindrance, without delay, without payment" (Vidal, 2018) the difficulty lies, nevertheless, in defining the strategy and modalities for the adoption of economically sustainable model. The National Open Science Plan was launched in

France in 2018, followed by a new Plan in 2021 that place scientific information at the heart of the Open Science revolution. Structured around several axes, the plans are broken down into the generalization of Open Access to publications, the structuring and opening of research data, the inclusion in a sustainable, European and international dynamic, the openness and promotion of source code and the evolution of the practices (MESRI, 2018, 2021).

In 2019, the CNRS Roadmap set in stone the main lines of the scientific policy for the production, dissemination and evaluation of scientific information according to the principles of Open Science[13] and DORA[14]. Contrary to the choices made by some European countries, among them Germany and Austria, France and the French National Centre for Scientific Research (CNRS) support genuine Open Access and oppose as much as possible the payment of APCs. Especially, they fight the "transformative agreements" that place the cost of Open Access on research institutions that are mostly publicly funded in France. Indeed, in front of journals claiming to be Open Access in which authors are required to pay APC to be published and of hybrid journals (partially by subscription and partially with APCs), "diamond" models such as episciences and Freemium are imposing themselves as alternatives controlled by research actors who respect authentic Open Access, particularly in SSH. The French National Research Agency (ANR), which funds public and partnered research, launched an action plan to "promote the open dissemination of research data" and requires a Data Management Plan (DMP) for any project it funds after January 1, 2019. In May 2021, Institut Pasteur (IP, 2021) has set itself the goal of reaching, by 2021, 100% of the year's publications in Open Access under the CC-BY license and without embargo, either in a native Open Access journal, or by depositing their publications in the HAL-Pasteur open archive.

THE SPECIFIC ROLE OF THE SOCIAL SCIENCES AND THE HUMANITIES IN THE EVOLUTION OF OPEN ACCESS MODELS

The Social Sciences and the Humanities (SSH) have played and continue to play an important role in the democratization of access to scientific works and with regard to developing countries that cannot afford expensive journal subscriptions. For the humanities and social sciences, for which funding is often very difficult to obtain, the choice of Open Science, in particular the alternative Open Access models produced by the scientific community, has been a very important step in the organization and dissemination of their scientific work. Facing the onslaught of commercial publishers and their Open Access costs, the objective was indeed to find solutions that would preserve basic research in SSH from excessive spending on subscriptions to packages of journals. With the initiatives launched by the world scientific community (Freemium, e-journals) and the open archive repositories, it is progressively proven that there are viable, sustainable, and equitable alternatives to commercial models of Open Access publishing at very low costs that favor investment in research (Kosmopoulos & Pumain, 2018). SSH mobilizes interesting Open Access initiatives in various areas such as open methods for scientific translations, data sharing, new generation of metrics including quality assessment, semantic impact analysis promoting the emergence of new fields of research etc.

Alternative uses of Internet for truly Open Access scientific publication are possible and sustainable such as attested by the example of Cybergeo: European Journal of Geography (Cybergeo, 1996-). Choosing Cybergeo may appear anecdotal but is rather representative of the energy and ability of anticipation that are required to develop viable alternative solutions. This pioneered entirely digital journal was launched as early as 1996. Without any cost to the author or the reader since its creation, Cybergeo is a

scientific journal open to all themes and school of thoughts in geography and related disciplines, with a multilingual content and a trilingual interface. It ensures a worldwide diffusion of research whose quality is guaranteed by several international reading committees. The double anonymization of the peer review system (texts, codes, data etc.) respects the highest scientific and ethical criteria. To promote cumulative, reproducible, and open geographic science, the journal launched a Model papers section in 2014 and a Data papers section in 2017. To our knowledge, this is the only journal in geography to this date that publishes this type of article. Each of these two sections has an editorial board of about 20 experts in the field, who evaluate the articles and accompanying supplementary material.

Cybergeo is multilingual since the beginning in 1996, with an interface in French, English and Spanish. Papers are published in different European languages (English, Spanish, Italian, German, Greek, Hungarian, Swedish...). The journal enlarged its editorial policy for international publication, including the translation into English and Spanish of all metadata. Since 2011, a program of translation of selected articles into English and Spanish has been launched. In 2018, Chinese translation of metadata (titles and abstracts of recent articles) was inaugurated, provided by volunteer researchers and contract workers. In 2019, the CybergeoNet project funded by the French Ministry of research was initiated to reinforce the multilingualism of the journal and to develop with other Open Access journals a sharing low-cost, innovative, and efficient translation method[15].

Regarding its economic model, Cybergeo joined the alternative Freemium publishing model independent of commercial publishers and launched in 2012 by the French platform OpenEdition. OpenEdition hosts several hundred SSH's journals that have adopted this "diamond" model. This model offers a subscription, at variable cost depending on the PIB's country, to the Freemium member journal bouquet at universities and research centers the world in exchange for a whole range of services. Freemium is entirely controlled by research actors and respects authentic Open Access to peer-reviewed scientific publications without cost for the author or the reader. Founded a few years before the creation of OpenEdition, Cybergeo is the oldest French Open Access digital journal in SSH (Kosmopoulos, 2002). Cybergeo's publishing policy is declared in Sherpa-Romeo under a CC-BY license (each journal on OpenEdition is independent in the choice of its copyright). It is supported by libraries all around the world subscribing to Freemium, but also by the investment of researchers associated for 25 years in the editorial and reading teams to ensure the scientific quality of an international journal, as well as the support of the laboratory Géographie-cités and the French National Centre for Scientific Research (CNRS).

The estimated cost of the entire editorial service, from submission on a platform, through peer review, to posting an article online in an Open Access journal such as Cybergeo is estimated to be around 600–700 Euros per article[16], far from the rates imposed for APCs by private publishers that are currently many times higher. Thanks to the interoperability, the journal is now referenced on dozens of academic sites around the world[17]. The downloads of its articles multiply to exceed one million per year since 2014. With over 1,200 publications and a worldwide readership, particularly in Latin America and Africa, Cybergeo is a success story (Kosmopoulos, 2016).

With a significant increase in the citation rate across disciplines, text and data mining, Open Access fosters cross-disciplinary fertilization and the emergence of new interdisciplinary fields. Web scrapping and semantic mapping for detecting paradigmatic similarities, convergences or intellectual niche creation could become a compulsory step not only when starting new research but all along the research process (Zhuang et al., 2020). Moreover, new publication strategies could become driven by the observation of these scientometric networks such as revealed by analyzing successful scholar trajectories: "these papers share remarkable boundary-spanning traits, marked by exceptional abilities to connect disparate and

topically-diverse clusters of research papers" (Sebastian & Chen, 2021). It is likely that in a near future such exercises will be part of all states of the art reviews in any domain, provided that scholars keep the monitoring of the required data mining and analytical processes according to their own scientific values and criteria.

The Impact Factor and the bibliometrics provided by the WOS or Scopus turned out to be particularly inadequate for SSH (Dassa et al., 2010; Kosmopoulos & Pumain, 2007). For all fields of SSH, the pioneering tool JournalBase (Journalbase, 2010), that gathers in a regularly updated table all journals existing in WOS (Thomson Reuters), Scopus (Elsevier) and ERIH (European Science Foundation) data bases, enumerates (after eliminating redundancies and inactive journals) about 15,000 international journals in SSH. By cross-referencing the different sources, it appears that not only none of them is representative of the publications in SSH, but that the indicators generated by the WOS and Scopus on the base of their indexes are biased and can lead to suspicion towards the SSH. A recent study focused on geographical journals (Dassa & Kosmopoulos, 2018) demonstrated that Scimago was not representative in comparison with the publications referenced by the French scientists in the academic database "RIBAC" for the SSH (CNRS). Including bibliodiversity, RIBAC allows to characterize and quantify the activity of the CNRS's researchers in SSH from different aspects. The increase in the visibility of scientific work via the Internet over the last three decades has intensified the spirit of competition exacerbated by the race for research funding (the "publish or perish" rule) and the attractive strategies of publishing platforms and scientific social networks. According to the CNRS ethics committee, a new awareness is emerging through Open Science (COMETS). It calls as well for a profound reform of the research evaluation system in the spirit of the Jussieu Call (2017) in Paris (France).. The Call, launched by a French group of researchers and scientific publishing professionals claims the recognition of bibliodiversity and the promotion of Open Access articles without APC.

The application CybergeoNetworks (2016) launched in collaboration with four young researchers[18] illustrates this process rather well. The scope was to explore Cybergeo's relationships and impact through citation network and by analyzing the semantic content. This Open Access application performs statistical and semantic analyses of data extracted from Cybergeo's peer-reviewed articles and online data associated with the journal (search engines, tweets, citations and publications). It allows, for example, to locate the authors of the journal's articles, the countries studied and cited in an international dimension, both cartographically and statistically, and to reveal emerging themes, as well as citation and dissemination networks (Raimbault et al., 2019). CybergeoNetworks supplies an alternative tool for analyzing the position of a journal in the scientific field as well, more precisely and more exhaustive than the quantitative bibliometrics of the WOS, Scopus and Scimago.

Facing the public costs of a few major private publishers, a European initiative from OPERAs in a consortium including the DOAJ has consolidated the Diamond Open Access model for the SSH. This "authentic Open Access", is proposed to qualify and distinguish the choice of free access without cost for readers and authors. According to a recent survey (Becerril et al, 2021), there are 12,000 journals in all scientific disciplines in Diamond Open Access, whereas the DOAJ itself on its website announced (at the end of March 2021) that an identification number has been given to some 16,232 Open Access journals among which 11,674 without APCs, representing almost 6 million articles in 80 languages and 125 countries. Thus, Open Access is widely diffused but not yet all over the world. SSH may continue to have a leading role to play in sustaining and developing these models. SSH journals that embrace the alternative peer-reviewed publication models of Open Access are engaging in a humanistic move-

ment that provides access to scientific publications to the global community, particularly to developing countries that are denied access for economic reasons to traditional and expensive journal subscriptions.

THE FUTURE OF OPEN SCIENCE IN EUROPE

The capacity for innovation shown by the scientific community since the advent of digital technologies to seize new opportunities and develop entirely new usage models such as Open Access is to be commended. It is at the origin of the strong impulse in favor of Open Science at the European level and of the will to adopt a global policy. Indeed, Open Science is no longer a trend, but a priority clearly expressed in the Framework research program Horizon Europe (2021-2027).

Based on eight 'ambitions' (European Commission, 2020): 1. Open Data: FAIR and open data sharing, 2. European Open Science Cloud (EOSC), 3. Future of scholarly communication, 4. Rewards, 5. Research integrity, 6. Education and skills, 7. Citizen science and 8. New Generation Metrics, Horizon Europe aims at harmonizing and effectively framing the diverse and heterogeneous initiatives which have flourished for several decades in different countries and institutions, and particularly within disciplines and research laboratories. In fact, the future of Open Science under Horizon Europe will depend on its capacity to gather the main Open Access initiatives to build a new sustainable ecosystem that is conducive to scientific progress.

The changes in practices and world vision are so profound that they make Antoine Petit[19] say that "Open Science is a revolution". The Commission is confronted with the complexity of the new ecosystem and its scientific and economic challenges. The choice of Open Science involves all public and private stakeholders and requires numerous consultations and a common strategy. The Commission must consider approaches and interests that seem sometimes incompatible, as evidenced by the example of the ERC's departure from cOAlitionS in July 2020 (ERC, 2020) due to its disagreement with the ban on hybrid journals as of January 1, 2021. "The ERC Scientific Council is working closely with the Commission services in order to find solutions that allow the rules related to Open Access under Horizon Europe to follow the legislative proposal and apply across all parts of the Programme, including the ERC" (ERC, 2020). Precisely one of the goals of Horizon Europe is to develop an Open Access publication portal, while the heterogeneous Open Access models (diamond, gold, hybrid, green, etc.) are still in conflict with each other, as described in this chapter. Which model(s) will win the support of a majority?

The opening and sharing of data are also a crucial issue for the European Commission. Although open data has been strongly promoted over the past two decades, resulting in the creation of hundreds of scientific open data repositories[20], one of the biggest challenges remains to make their reuse possible by humans and machines. It therefore requires research data to be FAIR i.e. findable, accessible, interoperable and reusable[21] according to common open protocols, norms and standards in terms of format, metadata, licenses, identifiers, copyright etc. The European Open Science Cloud (EOSC) is the flagship project of Horizon Europe. The aim is to finalize the development of a federated and open multidisciplinary environment where European researchers will be able to publish, and more generally where innovators, companies and citizens will find open data (including publications), tools and services for research, innovation and education. It goes to meet the idea to "engage and involve citizens, civil society organizations and end-users in co-design and co-creation processes and promote responsible research and innovation" (European Commission, 2020).

However, the implementation of open data still generates many issues about the definition of standards and norms, their durability, their reproducibility, their evaluation, the applied licenses, etc. as well as global recommendations about data management and data stewardship practices. Apart from technical challenges in the areas of open data (including publications), other practical questions are still on hold such as employment, costs, income, training, skills, etc. No precise cost estimates for implementing FAIR data have been produced by the Commission yet. It however assumes that if "the additional costs allocated for data management are up to 2.5% of all research expenditures, this would leave a positive balance of ~ €2.6bn per year from the implementation of the FAIR principles. Moreover, not all the costs for implementing the FAIR principles would be recurrent. Once the proper infrastructure in place, one could expect the net benefits from the FAIR principles to increase. We are confident that the true cost of not having FAIR research data is much higher than the estimated €10.2bn per year." (European Commission. Directorate General for Research and Innovation. & PwC EU Services., 2018).

Open Science also raises questions about the intellectual property rights on the research outputs such as publications, and all other digital objects produced by scientist such as data bases, software, methods etc. Many open licenses are proposed, but they are not all written in the same terms depending on whether they are issued by the research community or by private scientific publishers. The open licenses of commercial publishers such as Elsevier, for example, contain restrictions that are not yet in line with the ambitions of Open Science, which claims creative commons 4.0 type licenses.

Open Science is also a springboard for profound reforms in terms of assessment and rewarding researchers as well as the evaluation of European projects. The intention is clearly to abandon the impact factor of journals and to bring true recognition to the "bibliodiversity" meaning all types of scientific outputs. In front of the devastating principle "Publish or perish", the aim is to encourage scientific production of all kinds and to favor a qualitative assessment rather than the current impact factor. The development of open archives and FAIR data repositories are the pillars of the implementation of this new evaluation system. As an example, in July 2021, the ERC announced its "formal endorsement of the San Francisco Declaration on Research Assessment (DORA), in line with its long-standing adherence to the highest standards of research assessment. The ERC is convinced that the broad implementation of research assessment procedures that integrate the DORA principles is the key to an equitable transition to Open Science." (ERC, Work Program for 2022).

Simultaneously in France, starting in 2021, CNRS researchers must provide 10 flagship productions including not only research articles but also any type of data, source codes, videos, interviews, patents etc. accompanied by a self-evaluation according to the eighteen DORA commitments. The "Open Science and evaluation practices" meeting held in Paris at the end of 2021, brought together experts from the European Commission, funding agencies and academic and institutional leaders. While echoing the ambitions of Open Science, they recognized the difficulty of the transition. Questions remain regarding peer reviewing such as the adaptation of criteria according to scientific fields, the assessment of interdisciplinary themes, the time and skills needed by experts to examine all types of productions, the risk of falling back into a new system of quantitative indicators etc.

CONCLUSION

The development of the Internet has been a "breakthrough" innovation to facilitate and accelerate exchanges, which has renewed models and practices for transmitting scientific information. It has returned to

the true meaning of scientific knowledge in the service of mankind. The Covid-19 pandemic showed the necessity to find a balanced agreement between all the protagonists of scientific publishing to equitable freed up research results, accelerate information sharing and facilitate scientific progress (UN, 2020).

The variety of Open Access models highlights not only the economic and financial tensions that are at play on all sides, but also the innovative strength of the academic community. Considering that articles in journals are no longer the only means of sharing scientific information, Open Science offers access to a plurality of research contents and promotes new methods of dissemination and data sharing, including new approaches to the calculation of the impact. By improving our ability to write, publish and disseminate in different languages, Open Science will fully promote universal access to scientific outputs. Nevertheless, one should not forget that what determines the value of scientific knowledge, as opposed to opinion or ideology, is the possibility of its reproduction, its repetition and definitely its validation by "peers". Peer review is of fundamental importance; this remains one of the many challenges in ensuring the certification of diverse high-quality Open Science.

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KEY TERMS AND DEFINITIONS

ANR: French funding agency of research projects.

Article Processing Charge (APC): A publisher's fee paid by an author (or their lab or grant) that is used to support the process of publishing a journal article. The result is usually gold (immediate) open access to the research output.

CNRS: National Center for Scientific Research (France).

Data Management Plan (DMP): It is a synthetic document that aims to help in the management of a research project data by describing all the steps of the construction of the data.

Data Paper: A scientific article that describes and freely shares the datasets produced by the authors.

DOI: Perennial and unique identifier that allows to reference, cite, and provide a stable link to the online publication.

Embargo: Some publishers reserve a period of exclusive distribution. The European Union recommends a maximum embargo of 6 months and 12 months for the SSH.

FAIR Principles: Best practice principles to enable academic open data to be Findable, Accessible, Interoperable, Reusable.

Horizon Europe: New Framework Programme from the European Commission. It will run from 2021-2027.

Hybrid Journals: Journals that require a subscription but in which the author can choose to publish an article in open access for a fee.

Licences: The licenses specify the rights of distribution and reuse of publications and data. - On the commonly used international licenses (excluding software source codes): Open Source Initiative: https://opensource.org/licenses; Creative Commons licenses: https://creativecommons.org/choose/?lang=en.

Predatory Publishers: Publishers who charge authors for an open access publication but offer no expertise (no scientific committee, poor or non-existent review process).

ENDNOTES

[1] "Transformative agreement" is an umbrella term describing those agreements negotiated between institutions (libraries, national and regional consortia) and publishers in which former subscription expenditures are repurposed to support Open Access publishing, thus transforming the business model underlying scholarly journal publishing, gradually and definitively shifting from one based on toll access (subscription) to one in which publishers are remunerated a fair price for their Open Access publishing services….These agreements are a significant departure from the previous standard in subscription license agreements, as they bring the two transactional sides of subscription-

based journals, reading access (subscription fees paid by libraries) and Open Access publishing ("hybrid" APCs predominantly paid by authors), under one centrally negotiated agreement" (*ESAC Initiative*).

2 Launched in 2012 at the annual meeting of the *American Society for Cell Biology* in San Francisco, DORA has been signed so far by more than 20 000 Institutions and Universities.

3 "It should be emphasized that the basic purpose of the project is not to take a statistical inventory of scientific production. That is, indeed, an important byproduct of the work. The main objective, however, is to develop an information system which is economical and which contributes significantly to the process of information discovery – that is, the correlation of scientific observations not obvious to the searcher. Citation Indexes can provide new insights impossible through descriptor-oriented systems." (Garfield, 1963)

4 Science Europe is an association of scientific organizations, based in Brussels, which also contributed to the coordination of the Open Science plan.

5 Funder cOAlition S from about 15 European countries.

6 Declaration of the three French learned societies for Mathematics. *Open Access*: a warning on the inherent flaws of the « author pays ».

7 EOSC is a 'federated ecosystem of research data infrastructures' to share and process publicly funded research results and data across borders and scientific domains.

8 3 mai 2016, Art. L. 533-4.-I.

9 Ministère de la culture et Ministère de l'enseignement supérieur, de la recherche et de l'innovation.

10 "With a budget of €16.4 million for the period 2017-2021, the publishing support plan includes the multi-year consolidation of journal purchasing policies, coordinated at the national level (€13 million), and subsidies for the platforms that distribute them (€2.45 million). It also includes studies on journals and distribution platforms (€0.26 million), as well as support for translation (€0.7 million). The journal order pools took effect in 2017, while the modalities for expanding Open Access were only put in place at the end of 2017 for EDPScience, from 2018 for Open Edition, and only in January 2019 for Cairn." (Renoult D. (Comité de suivi pour l'édition scientifique), 2019).

11 represents several hundred higher education and research French institutions.

12 The multidisciplinary national open archive HAL is intended for the deposit and the diffusion of scientific articles of research level, published or not, and theses, emanating from French or foreign teaching and research establishments, from public or private laboratories.

13 "Our goal: 100% of publications in Open Access" (Alain Schuhl, 2019, deputy director general for science at CNRS); "CNRS: an ambitious plan for accessible and reusable data" (A. Schuhl, 2020)

14 The CNRS signed DORA in 2018.

15 The final report will be published in 2022.

16 This price includes the salaries of the researchers and evaluators paid by the public service.

17 Curious as it may seem, some libraries could not make a free journal available to their readers without a subscription invoice for that journal.

18 Pierre-Olivier Chasset, Hadrien Commenges, Clémentine Cottineau, Juste Raimbault

19 General President and Director of the CNRS in France.

20 Re3data is a global registry that indexes all research data repositories.

21 The term FAIR was launched at a Lorentz workshop in 2014, the resulting FAIR principles were published in 2016.

Chapter 2
Open Access Initiatives in Ethiopia's Higher Learning Institutions

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ABSTRACT

Ethiopia is one of the world's oldest civilizations with a population of about 120 million (2022 estimate). Ethiopia suffers from declining higher education quality, resulting from the rapid growth in the number of institutions (from three in 1990s to 50+ public Universities and 327+ private higher education institutions in 2022), the rapid expansion in tertiary student enrollment, as well as the lack of basic entrance qualifications. The quality of education in Ethiopia is further impacted by their limited access to critical content or knowledge as evidenced by limited subscriptions to scientific and technical databases. In recognition of open access's (OA's) potential to fill disadvantageous access gaps and enhance the overall educational quality, Ethiopia adopted a National OA policy in 2019. Among other enforcement mechanisms and guidelines, the policy requires universities to deposit all publicly funded publications in the National Academic Digital Repository of Ethiopia as well as in an institutional repository. In this chapter, the authors outline the state of OA policies and practices in Ethiopia's higher learning institutions.

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INTRODUCTION

Knowledge is universal and it must be disseminated without time and space limitations. Open Access (OA) is acclaimed to remove time and space barriers for disseminating research outputs. It has the potential to positively impact research, teaching and learning in Higher Learning Institutions (HLIs) by facilitating knowledge and information sharing within academic communities. Although OA became an important agenda for HLIs in the late 20th century in developed countries, it is even a more recent phenomenon in developing nations. Because OA is a recent issue for developing nations, knowledge and data sharing policies and procedures are in their infancy.

With further development of OA policies and procedures, greater visibility of HLI research products can be achieved. As it is now, sub–Saharan African countries contribute less than 1% of the world's publications (Piron et al., 2019). Ethiopian universities and research institutions experience a multitude of challenges disseminating scholarly research results. Some of these challenges are technical such as bandwidth, economical (e.g., budget constraints, low staff salary, poor incentive mechanisms) and others are mainly social (e.g., research culture) The lack of infrastructure for science communication significantly hinders developing nations' ability from both actively participating in knowledge generation as well as from enhancing the visibility of their scholarly works. Nonetheless, OA policies and procedures show promise for eroding the barriers experienced by developing nations.

The Ethiopian government has been working ambitiously to expand HLIs and to equip universities with the required teaching, learning and research materials. For example, the government allocated some fund to pay for the subscriptions and/or purchase of books and journals at all public universities and research institutions. This budget is, however, very limited and, hence, does not cover subscriptions to international journals. As the number of journals and cost of journal subscriptions continue to climb, let alone to add new items, it is not possible to maintain even same subscription with the allocated budgets. Accordingly, universities are searching for more access options to meet the needs of scholars (Getaneh, 2009; Chuan & Kaur, 2009). That is not to say that traditional subscription models are ineffective; just that their costs are prohibitive and that supplemental models are needed to overcome financial barriers. Given the overwhelming cost and access issues, the focus on developing OA systems is the concern of MOE and all HLIs. Without increased accessibility and visibility, researchers will not gain recognition nor contribute to the world's scientific outcomes. Likewise, scholars in developing nations will remain distant from scientific knowledge produced by the rest of the world. The transformation from the traditional journal subscription models to OA models is therefore a timely and necessary endeavor.

Although many stakeholders argue that access challenges in low- and middle-income countries are often related to infrastructure, OA would indeed, boost access for researchers at poorer institutions. The introduction of OA in developing countries like Ethiopia has several advantages for scholars and their HLIs. First, OA increases access so that other researchers can use and cite the works of Ethiopian researchers and scientists. Second, the openness of their publications increases the visibility and impact of their scholarship across the globe. Third, with greater visibility should come increased opportunities for networking and international collaboration for Ethiopian scholars. This in turn, promote interdisciplinarity may provide greater professional development and partnership opportunities that ultimately benefit the students they mentor and raises the general quality of education. Fourth, OA reduces journal paywalls that severely inhibit the quality of research, teaching, and learning at Ethiopian HLIs (Ezema & Onyancha, 2006). The promise of OA systems is striking. There is little doubt that mandatory OA

projects amongst Ethiopian HLIs will enhance the visibility and recognition of their scholarship and accommodate the ever-increasing internal needs.

Libraries around the world are at the fore front to call for a shift to new scholarly communication approaches, mainly due to the excessive subscription costs under existing publication models. In the same way to the experiences of other countries, open access initiatives in Ethiopia can also be attributed to Libraries' effort in higher learning institutions of Ethiopia. The existing efforts and success stories in Open Access was begun by combined efforts by Electronic Information for Libraries (EIFL) and the consortium of Ethiopian academic and research libraries. The issue of OA as a main target of discussion in Ethiopia was started in 2014 by AAU with the support of many stakeholders like EIFL. The main goal of the initiative is to share information and knowledge among the academicians and the public at large by making theses, dissertations, research outputs, journals and any data that could be used as source for academicians and researchers. To further the main goal of sharing information and knowledge globally among academics, we strive to further stimulate conversations and innovation by providing a detailed appraisal of the current status and progress of OA initiatives in Ethiopia.

BACKGROUND

The discussion about openness in Ethiopia started in 2000 when scholars from Addis Ababa University participated in the Database of African Thesis and Dissertations Research (DATAD-R) project (Mary, 2003) led by the Association of African Universities. The objective of DATAD-R was to develop a regional database of theses and dissertations. The project culminated in the launch of an online database of thesis and dissertation abstracts from Universities in Africa in 2003. Though DATAD_R was not specifically an open access project, it stimulated conversations about open access benefits among African academics, including those in Ethiopia. The success of DATAD-R project helped birth an open access project at Addis Ababa University (AAU) in 2007 called Electronic Thesis and Dissertation (ETD). Following the AAU-ETD model, other Universities and research institutes, including the Forum for Social Studies, St. Mary (private) University, and Haramaya University, opened their own repositories.

In addition to the launch of the first few institutional repositories, the Consortium of Ethiopian Academic and Research Libraries (CEARL) offered training and workshops on OA. While this helped disseminate information about OA, encouraging others to follow suit, several universities reported that the lack of OA policy hindered progress in their OA repository projects. To address policy issues, in 2014, Addis Ababa University in collaboration with Electronic Information for Libraries (EIFL) hosted a workgroup on OA policy development. The workgroup developed an AAU OA policy, which was later shared to all members of CEARL for adoption. Jimma University is the first University in Ethiopia to have approved policy in 2018 followed by Adama University, and Arbaminch University in the same year and then Hawassa University in 2019. Parallel to the creation of institutional OA policies, CEARL proposed a national OA policy to Ministry of Education (MOE) in 2017, which was adopted and put into effect in 2019.

The success of OA repositories at AAU and other Universities sparked enthusiasm among the publishing community. Local journals started working to open publications to the world, eventually leading to the launch of the Ethiopian Journals Online (EJOL) project by AAU and EIFL. The EJOL platform was launched in 2014 with six open access journals. After moving to MOE's national platform, the participating journals increased four-fold to 25.

METHOD

For the current review, appraisal procedures from the Budapest Open Access Initiative has been adopted (BOAI, 2002). In the BOAI, scholars employed a variety of metrics to help ascertain the maturity of OA initiatives. They applied a set of criteria for assessing OA initiatives related to infrastructural development, OA policy, and awareness of OA systems among the academic community. When examining OA initiatives from the perspective of infrastructure development, institutional repositories and their functionality are standardly considered. Moreover, the extent to which the generation and implementation of OA policies ensure fair use of copyrighted information for educational and research purposes is assessed. Finally, appraisals of OA initiatives often rely on researchers' collaboration with HLIs and in alignment with OA publishing principles.

To conduct this investigation, data were extracted from publicly available secondary sources such as HLIs' websites, official letters, policy documents, and observations during the authors' participation in OA workgroups and committees. We employed the BOAI framework to appraise four main issues pertaining to OA initiatives in Ethiopian HLIs. First, we examined the extent to which OA policies have been adopted; second, we explored the availability of the infrastructures, in terms of connectivity and software platforms, that are necessary to bring about sustainable OA outlets; third, we surveyed researchers' and other stakeholders' awareness via OA campaigns and training programs; and finally, we computed the number of research outputs from Ethiopian HLIs in OA journals and explored the use of Gold OA routes . We report our findings in the subsequent sections, organized according to these four overarching issues.

OA POLICIES AND IMPLEMENTATION

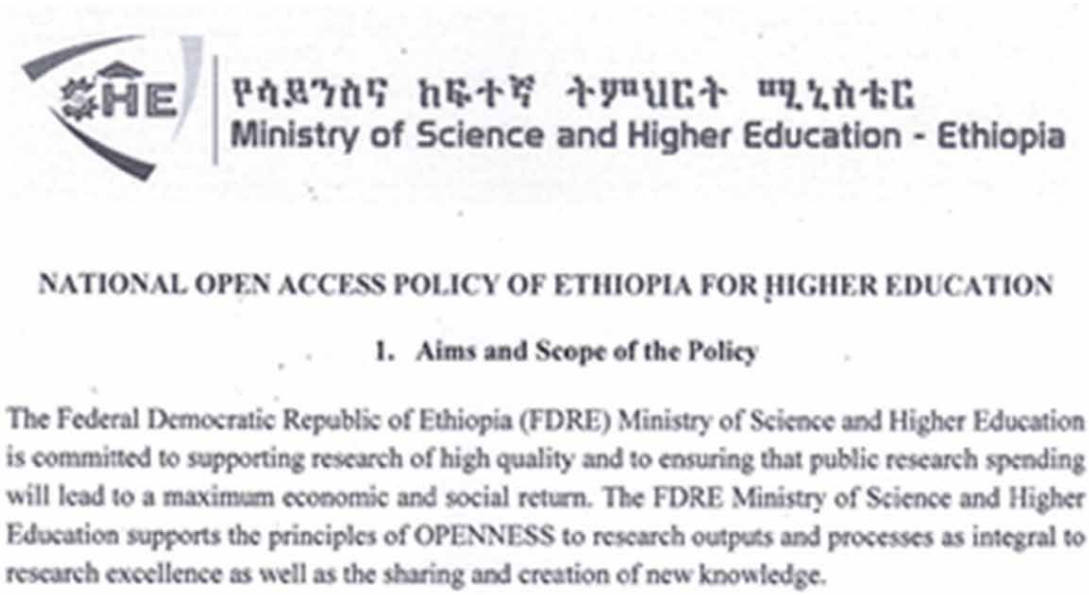
The aim of OA policy is to provide free online access to HLI outputs in the areas of research, capacity building training, and the like. University research outputs are deposited into established repository systems. Repositories allow for the research products to be accessed without cost immediately and ensure long-term preservation and ongoing dissemination (IIfPHC, 2020). OA policy documents drafted by the respective HLIs govern the procedural and administrative issues related to the OA systems.

Electronic Information for Libraries (EIFL) played critical role in introducing OA policy to Ethiopian HLIs. EIFL, a nonprofit organization, took the leading role in advocating for changes in systems of scholarly communication most importantly in developing countries such as Ethiopia. Due to the support of EIFL, many new OA policies have been established in universities and research funding agencies in developing countries. These policies are increasing access to knowledge and making it possible for institutions and scholars in these countries to share their research outputs to the world, which in turn increases the visibility of their work.

Realizing that OA scholarly communication benefits from clear policies and implementation strategies, the Ethiopian Ministry of Science and Higher Education (MoSHE) established a policy system by which the OA model is monitored. The MoSHE policy applies to all research outputs produced by employees of Ethiopian public universities. The national OA policy proposed by the Ethiopian Consortium of Ethiopian Academic and Research Libraries was drafted in 2017 and then circulated to all public universities for adoption. The MoSHE OA policy was officially adopted in Ethiopian in 2019.

The Ethiopian Ministry of Science and Higher Education (MoSHE) in collaboration with Addis Ababa University implemented the National Academic Repository of Ethiopia (NADRE), which is a national repository that harvests publications from local repositories maintained by individual institutions in Ethiopia. Universities are continuing to implement and support their own institutional repository system and contribute their deposited products to NADRE. As shown in Figure 1, the procedures for opening access and depositing research products into the repositories, including dissertations and theses, are clearly outlined in the National Repository policy (MoSHE, 2019).

Figure 1. National open access policy for EHLIs



የሳይንስና ከፍተኛ ትምህርት ሚኒስቴር
Ministry of Science and Higher Education - Ethiopia

NATIONAL OPEN ACCESS POLICY OF ETHIOPIA FOR HIGHER EDUCATION

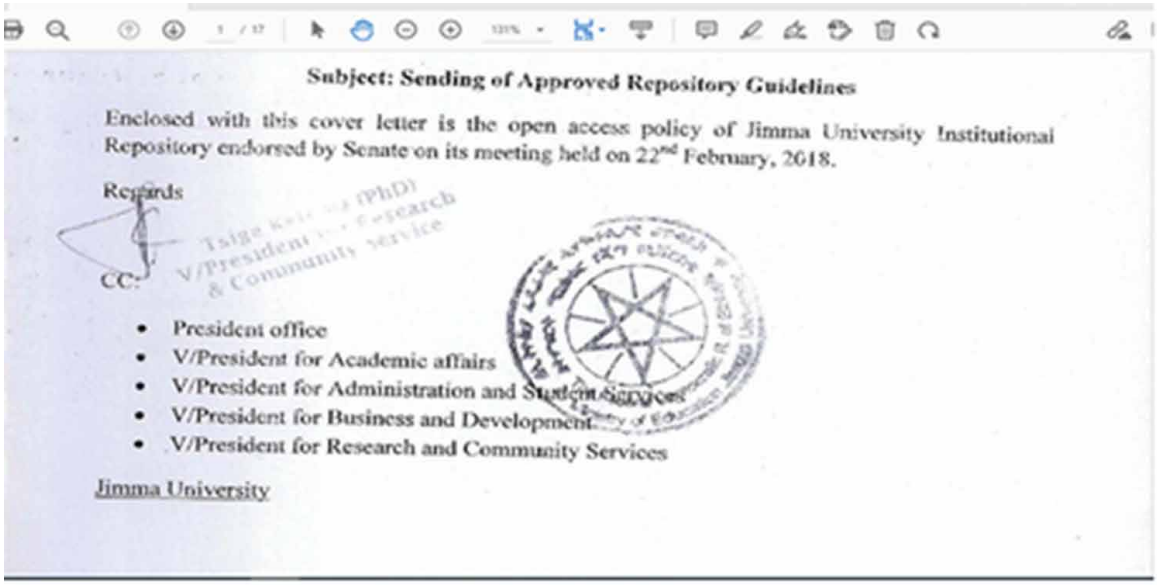
1. Aims and Scope of the Policy

The Federal Democratic Republic of Ethiopia (FDRE) Ministry of Science and Higher Education is committed to supporting research of high quality and to ensuring that public research spending will lead to a maximum economic and social return. The FDRE Ministry of Science and Higher Education supports the principles of OPENNESS to research outputs and processes as integral to research excellence as well as the sharing and creation of new knowledge.

Jimma University was the first university to have approved OA policy (see Figure 2). Other public universities such as Arbaminch University and Hawassa University have also approved their own respective OA policies. Jimma University's OA policy, for example, addresses OA policy statements; selection, retentions, replacement and withdrawal of data; types of publications that should be deposited; information needed and submission deadlines; the version of the manuscript that needs to be available; the embargo period; quality control; management; compliance with the policy; data of enforcement; and policy review (Jimma University, 2018).

Hawassa University's OA policy, similarly, states that research outputs and data available in the repository can be accessed via the university's website or in any search engines (e.g., Google) and presents the specifications for any work that could be made available in the repository system (Hawassa University, 2020). It is believed that the new national OA policy encourages open science practices by including 'openness' as one of the criteria for assessment and evaluation of research proposals. The policy addresses issues related to data submission, data handling and data sharing.

Figure 2. Open access policy of Jimma University



Subject: Sending of Approved Repository Guidelines

Enclosed with this cover letter is the open access policy of Jimma University Institutional Repository endorsed by Senate on its meeting held on 22nd February, 2018.

Regards

CC:

- President office
- V/President for Academic affairs
- V/President for Administration and Student Services
- V/President for Business and Development
- V/President for Research and Community Services

Jimma University

Researchers who receive public funding are supposed to submit data management plans to university libraries for approval. Plans should outline how the data are handled in accordance with international data handling principles such as accessibility, interoperability and reusability. At the same time, the NADRE and universities are responsible for ensuring that all publications based on publicly-funded research are deposited in their archives. Although OA policy is an important issue for HLIs, to date only 3 of the 47 universities under the MoSHE (i.e., Hawassa University, Jimma University and Arba Minch University), have so far adopted/created OA policies.

New OA policies are expected to increase the visibility of Ethiopian research within national and international research communities and raise the quality of Ethiopian research as researchers will see and verify each other's work. The adoption of an OA policy and system helps practitioners in organizations to access research outputs. Sharing research and data openly makes duplication monitoring possible, thereby saving costs, time, and effort.

OA system and policy adoption in most of Ethiopian public universities, particularly second, third and fourth generation universities is, however, still not implemented. Despite their growing recognition for the need for OA policies and procedures, many universities are hindered by the lack of basic infrastructure. They are limited in terms of hardware and software. Nonetheless, second, third and fourth generation universities are working diligently to expand their infrastructure that can be leveraged to support OA policies and practices.

INFRASTRUCTURAL DEVELOPMENT

Infrastructure refers to the hardware and software needed to realize an effective OA program in the country. In these category, two issues are explored. The first is the data center and network connectivity issues and the second is the software platform issues.

Data Center and Network

Despite the fact that a rapid expansion of higher education is observed in the last two decades and the number of public universities grew to 46, there are still insufficient supplies of textbooks and reference materials, laboratories and workshop equipment, and access to Information and Communication Technology (ICT) facilities. One of the major efforts of Ethiopian higher learning institutions is the implementation of a National Research and Education Network (NREN). According to the statistical framework proposed during the World Summit on the Information Society (WSIS) in 2011 (Peña-López, 2011), a NREN is: "a specialized Internet service provider dedicated to supporting the needs of the research and education communities within a country. NRENs usually administer and support a high-speed backbone network; often offering dedicated channels for individual research projects" (p. 24). NRENs are supposed to solve the spread over of HLIs in wide geographical area across the country. The existing ICT infrastructures in Ethiopian HLIs are insufficient to support NREN services. Furthermore, the absence of ICT facilities supporting researchers and instructors hinders the exchange of viable educational material among members. The goal is to connect scholars to each other and with their global counterparts to share resources and collaborate to solve complex challenges of research and scientific issues.

Ethiopia, which is both a least developed country (LDP) and a landlocked developing country (LLDC), has been successful in creating EthERNet, which can enable Ethiopian researchers, scientists and educators to collaborate and work together with each other and with their colleagues in the rest of the world to develop a common and integrated solutions that can solve their common challenges (Bankole & Assefa, 2017). EthERNet was initiated by the government of Ethiopia in 200 as part of a national capacity building program. EthERNet is an Ethiopian NREN (national research and education network) and a member of UbuntuNet Alliance, which is a regional association of NRENs in east and southern Africa. It initially focused on the development of ICT infrastructure for public universities to share educational resources locally and globally and providing tele-education and tele-medicine that enabled the delivery of many types of trainings, classes and meetings.

EthERNet was launched to build and deliver highly interconnected and high-performance networks for universities and other educational and research institutions in Ethiopia. More specifically, EthERNet was aimed to build and deliver high performance networking that connected institutions with each other and similar institutions in the world, and by doing this to enable them to share educational resources and collaborate both within Ethiopia and globally and helping address and overcome the critical shortages of resources (Bankole & Assefa, 2017).

Currently, all Ethiopian universities are not benefitting from EthERNet because they do not have standard campus network infrastructure. Hence, member institutions should have to have a standard campus network to use the service provided by EthERNet and to serve their campus communities.

Campus networks are the foundation for any effort in building national and regional research and education networks. They should be designed in a way that supports learning, teaching and research, as well as administration. It should also support network and data management issues including like data protection, bandwidth reservation and management, helpdesk services, training, documentation, applications, security and authentication take place at the campus levels. To benefit from the investment made by EthERNet, member institution needs to have their own standard campus network to be connected to other institutions through EthERNet. However, EthERNet has limitations that prevent it from maximizing its potential.

The EthERNet limitations include lack of computing infrastructure in data centres; EthERNet is not yet connected to the Global NREN; security and reliability of the network; lack of application services for teaching and learning; lack of application and infrastructure service for researchers such as collaboration tools, high performance computing, large file sharing, etc.; insufficient Internet bandwidth; lack of standard campus network infrastructure in some of the member institutes; lack of access device such as computers or smart mobiles sufficiently; and unavailability of last mile connectivity for remote campuses.

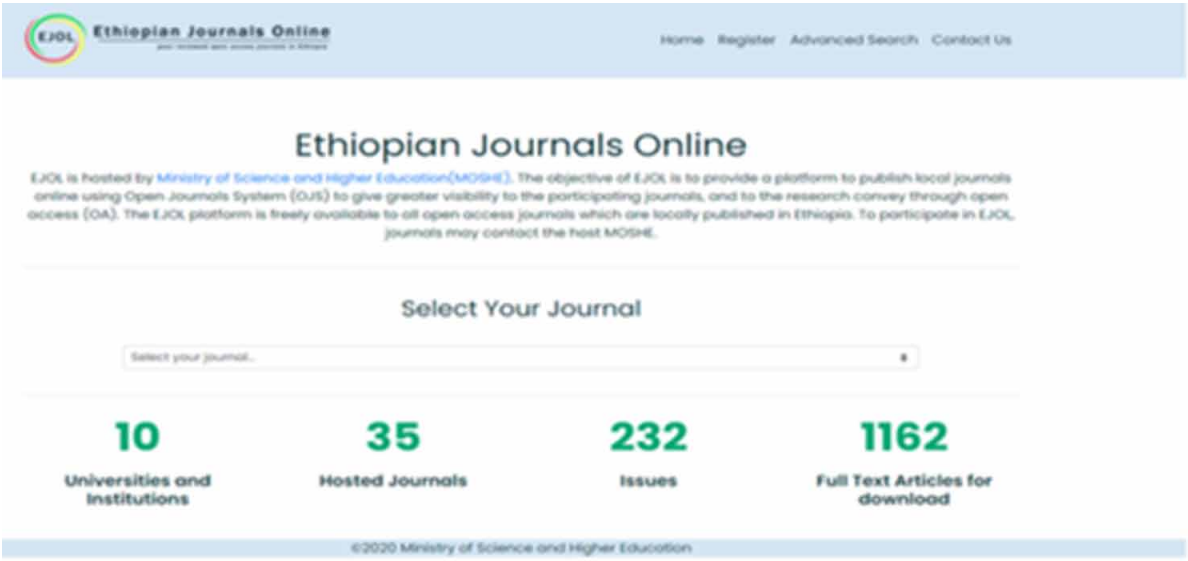
Besides the numerous barriers, there has been aggressive network infrastructure expansion and data-center infrastructure building in the last five years in collaboration with the MoSHE. Despite regular progress, there remains a long way to go to achieve the goal of sufficient infrastructures to realize OA initiatives in Ethiopia.

Open Access Platforms

The major OA repositories in Ethiopia were developed alongside the expansion of HLIs and the introduction of postgraduate programs in many universities. This has also come as a result of expansion of network connectivity and local data centers at different universities. There are many initiatives across HLIs to build OA platforms. A major initiative to build OA platforms came after the approval of OA policies in Ethiopia.

The former MoSHE in collaboration with Addis Ababa university initiated a project called "Developing Digital Platforms and Contents Project (DDPCP) for Public Higher Education Institutions use at EthERNet Data Center." The aim of this project was to design digital platforms at a national level and collect open access content from different universities in a central repository. The project also aimed to implement institutional repositories for 16 universities that have difficulty in establishing their own datacenter. As part of this project, a national open journal platform, Ethiopian Journal online (EJOL) (https://ejol.ethernet.edu.et), which was managed by Addis Ababa University has been implemented at EthERNet data centers. The platform is ready to be used by local journals for online publication. Figure 3 below shows the snapshot of this portal. A redundant copy of this system is also archived in Addis Ababa University Datacenter. The migration of this system to the national datacenter and related trainings as part of this project brought significant promotional effect among the HLI community.

Figure 3. Ethiopian journal online platform

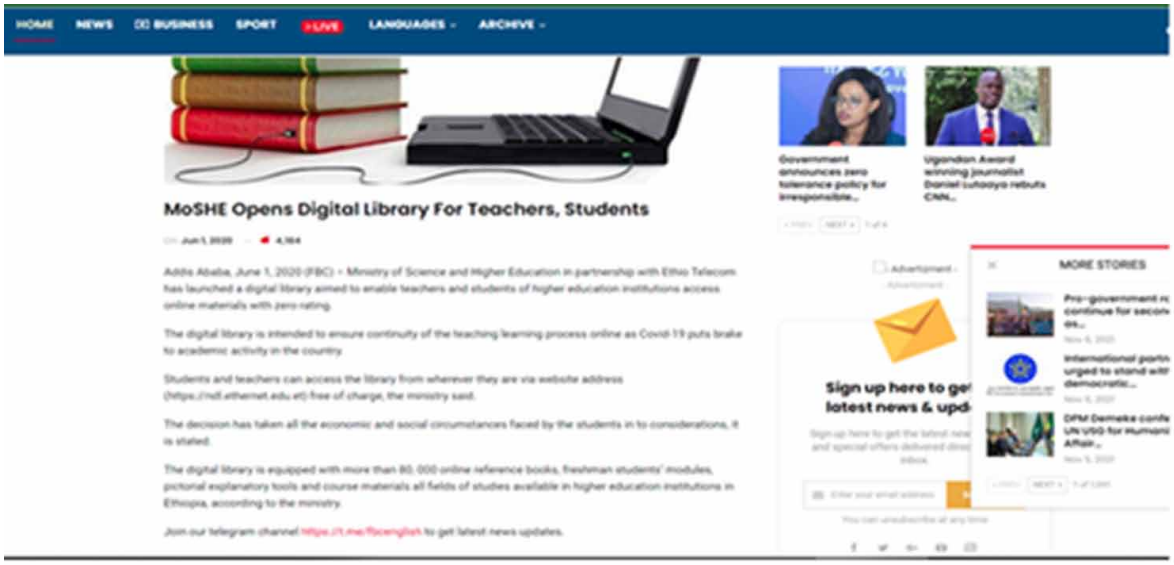


A national digital library based on the DSpace platform has been implemented at EthERNet data centers as shown in Figure 4, A total of 80, 893 full text e-books have also been uploaded into the digital library with standard metadata. This digital library, containing reference and educational materials such as course syllabi, was the only source of information for universities in Ethiopia during the time of Covid-19 pandemic.

Figure 4. Ethiopian digital library

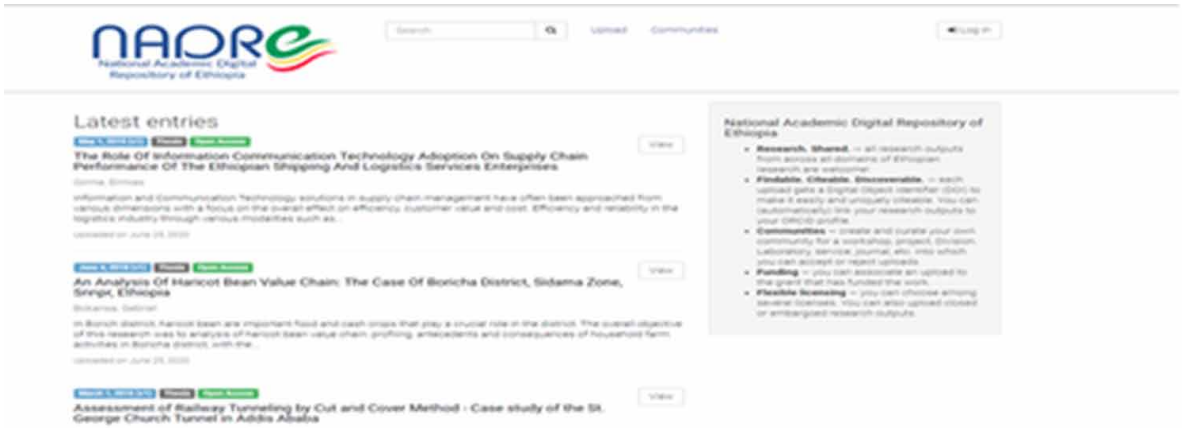
The national digital library was promoted through different media outlets and each university contributes their course materials based on OA licensing. Ethio-telecom allows students to download contents from this platform without accruing data costs. An example of how the platform was promoted in the news is shown in Figure-5 below.

Figure 5. Ethiopian digital library promotion



There were efforts to move contents from institutional repositories (IR) from regional universities such as Gonder, Jimma, Bahirdar and Addis Ababa into a central repository. As a result of this effort, significant amount of content has migrated to a national platform (Figure 6) especially from Addis Ababa University.

Figure 6. National digital repository



Despite the exceptional progress, these initiatives still require further efforts to make the work sustainable. For instance, only 12 out of 16 institutions implemented the IR. However, their data infrastructure capacity in the EthERNet datacenter was insufficient and it was difficult for MoSHE to provide ongoing support. Moreover, the majority of institutions lack professionals in library and information sciences. Additionally, there is substantial turnover of library professionals which aggravate the situation even more, as such turnover requires frequent and recurrent training on the topics needed to sustain the systems. Another barrier is that trainees consist of individuals who vary in their knowledge of library sciences. Different classes for individuals with basic versus advanced levels of awareness have been recommended, but this increases the number of trainings trainers must prepare and deliver. The frequency and diverse training topics demand substantial time of the trainers, making them difficult to manage. Moreover, institutions were advised to select qualified and appropriate trainees. The national digital repository would only be sustainable if there is standard content acquisition mechanism. It is observed that some faculties openly resisted the use of institutional repositories and making resources freely accessible. More advocacy activities among faculty will be needed through a series of follow up trainings on the deployment of OA policy for the institutes.

Success stories in building institutional repositories especially for thesis and dissertation open access initiative are available at a number of universities. The Addis Ababa University Thesis and Dissertation Repository (etd.aau.edu.et) which contains more than 26, 000 records is a good example (Figure 7). There are also ongoing efforts to digitize the existing hardcopy thesis and dissertation and to upload them into AAU's IR.

Figure 7. AAU's repository

Currently, about 13 universities under the ministry have IRs. However, due to policy and technical issues, the repository system belonging to only four universities are functional. For the sake of improving OA in all HLIs of Ethiopia, the Ministry in partnership with Addis Ababa University, has launched a project, managed by Consortium of Ethiopian Academic and Research Libraries and EIFL coordinator, aiming to hasten the establishment of IRs at all public universities as soon as possible.

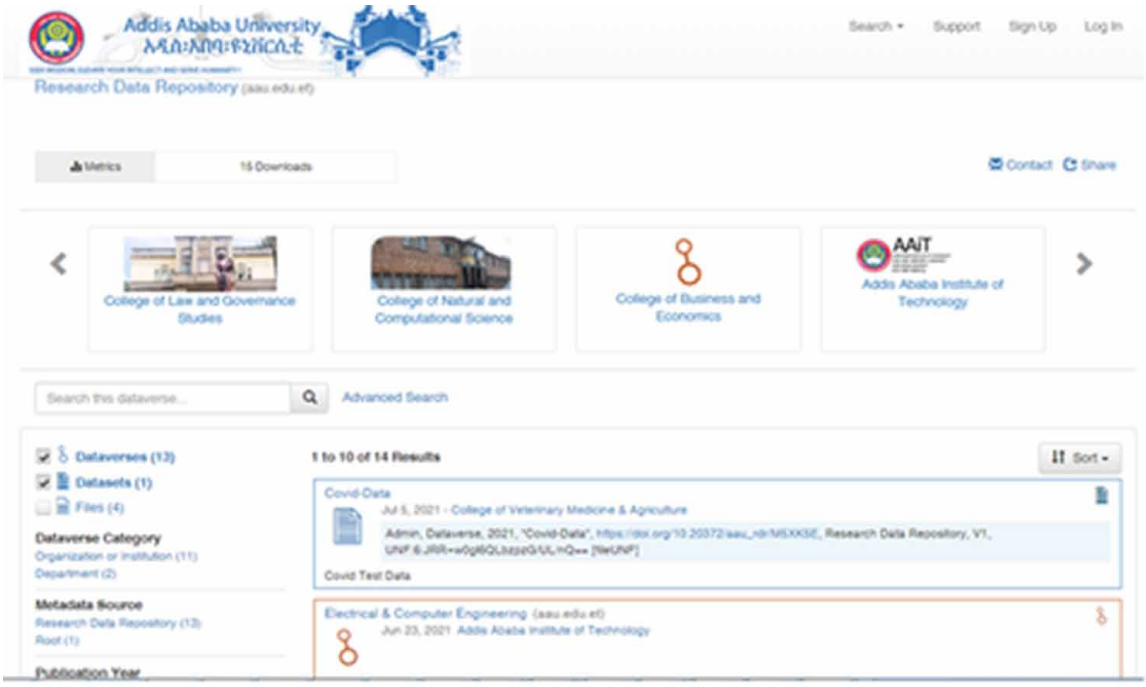
Other universities are also joining this initiative by implementing similar platforms. As shown in the subsequent figures Gonder (Figure 8), Haramaya (Figure 9), Bahirdar, Hawassa, Mekele and other universities offering postgraduate programs have implemented IRs.

Figure 8. University of Gonder IR

Figure 9. Haramaya University IR

Recently, Addis Ababa University has joined a broad international movement. As shown in Figure 10, the initiative seeks to implement a new data repository (rdm.aau.edu.et) to share research data. Among other pushing factors, the data repository was primarily motivated by the approval of data sharing policy of Addis Ababa University (AAU, 2020). Another important initiative that promotes open access movement at Addis Ababa University is the requirement to archive publishable articles (i.e., currently a requirement for graduation) of PhD and Master's students in AAU's IR in the form of preprint archive.

Figure 10. AAU's data repository



Despite many initiatives, sustainable open access infrastructure is yet to come. Platforms are not available 24/7. This is mainly attributed to lack of connectivity in different universities. As a result, many IRs from regional universities are not accessible at this time. Moreover, data curators and library professionals that can sustainably support platforms are not available. It is of paramount importance that building the capacity of library professionals is a mandatory prerequisite for building sustainable OA infrastructures in Ethiopia.

Awareness and Training Initiatives

Since the attempt to adopt OA systems started, it has become the concern of professionals in the field of information science to create awareness about OA among faculty and students. To increase awareness on OA Universities run series of workshops and trainings on OA. Some public universities in Ethiopia have introduced repository systems where theses, dissertations and any other data could be uploaded so that researchers or anyone else who needs can easily access them online. OA policy, which is believed important to the administration of OA systems, was also adopted by few first-generation universities.

To achieve the stated goal of OA system, providing targeted capacity building trainings for concerned bodies was found to be among the critical success factors. In 2019, Addis Ababa University and MoSHE conducted trainings on repository system management to repository managers, journal editors and researchers from respective public HLIs in Ethiopia. Meanwhile, online journal management training was given to journal editors. It is believed that the training helped repository managers and administrators to manage their new IRs. Training on "Institutional Repository Management "was delivered on 16-20, September 2019 to 57 participants representing Universities across the nation. Training on "Online Journals Management," was delivered to 40 participants from September 30 to October 4, 2019. The participants reported that problems related to infrastructure; frequent power interruptions; unavailability of server; among other issues, hindered the success of their OA initiatives.

In addition, a number of trainings and promotional campaigns were also conducted at different times for different universities by CEARL, EIFL and Addis Ababa University. Even if one-time training on repository systems and journal management was given to all OA stakeholders, it would not be sufficient. Training and capacity building requires continuous effort to make OA systems functional. As a result, the capacity of HLIs to support ongoing training and professional development is a high priority. As there are newly established public universities under expansion and construction, training and capacity building on OA needs to be continuously offered.

The number of publications in OA journals in Ethiopia is rapidly increasing. This only includes journals that are published in Gold open access outlets. Figure 11 shows the increasing trend OA publications in Gold open access journals by Authors from Ethiopia. The number of preprint articles published in preprint archives is also increasing as is shown in Figure 12.

Figure 11. OA publications in Gold open access journals by Authors from Ethiopia

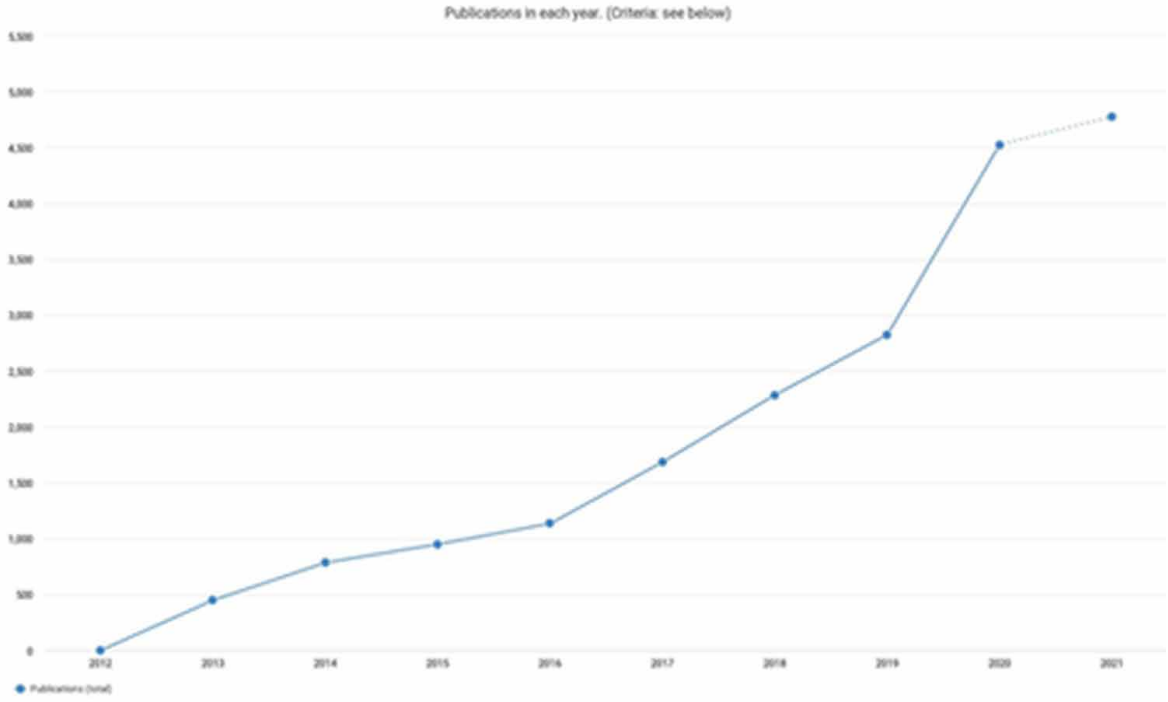
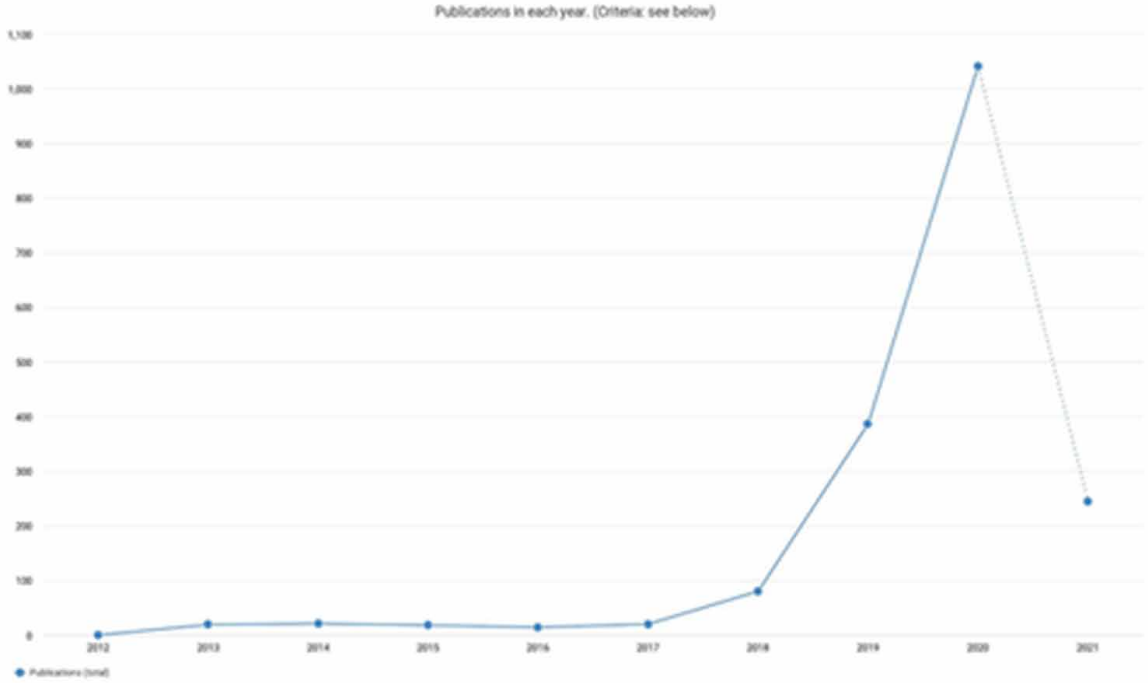


Figure 12. OA preprint articles publication by authors from Ethiopia



CHALLENGES AND OPPORTUNITIES

Challenges

The evolution of Ethiopian OA systems has been hampered by various challenges. In order to fully enjoy the benefits of OA, the challenges need to be addressed and overcome. The following challenges have been identified as the major bottlenecks that slowed the progress of OA initiatives.

Managerial and Professional Turnover

The Consortium of Ethiopian Academic and Research Libraries (CEARL) have conducted many trainings and workshops on OA to build the capacity of academic leaders and professional librarians. However, due to high turnover in managers and librarians, the trained professionals leave library environments without finalizing the OA projects they started at their respective libraries. The challenge is further complicated by the lack of scientific knowledge sharing practices, which limits the transfer of knowledge and skills to the new staff. This ultimately slows down or terminates OA initiatives until new staff can be hired and trained. The challenge of training and retention have been particularly detrimental to OA platform development and policy initiatives.

Dispersed OA Initiatives

Another challenge is lack of coordination among the number of organizations involved in OA initiatives in Ethiopia. Many different organizations have been supporting OA initiatives including CEARL, EthERNet, MoSHE, Higher Education Strategic Center (HESC), and Ethiopian Academy of Sciences (EAC). Although these organizations have contributed a lot toward OA successes in Ethiopia, some of their efforts overlap, which can result in wasting resources. The lack of coordination between and among these organizations slows down the decision-making process. Decision makers are often confused with the different initiatives and the various organizations that advocate for them. One of the areas of overlap was national policy development on which CEARL, HESC, and EAC were working separately. Eventually in 2018, CEARL, Ethernet and HESC established a coordinating committee to work on OA policy. This type of committee is considered best practice in OA collaboration. The collaboration also helped to implement the national repository and Ethiopia's online journals project led by Addis Ababa University and EthERNet.

Restructuring of Universities and Government Ministries

Ethiopian Universities have been engaged in reform initiatives to improve efficiency and enhance quality of Education. Similar initiatives are taking place within the MoSHE. These reform initiatives moved the OA projects to new offices which delayed the projects as the offices didn't have experience on managing projects. The restructuring of universities and the Ministry also required in the appointment of new managers which slowed the progress of OA initiatives as the newcomers took longer time to learn the values of OA initiatives and support it. Though we are discussing the challenges here, the reform also contributed positively to OA initiatives as most of the universities and the Ministry encouraged the implementation of library technologies and library automation, digital library and IRs.

Long Decision-Making Process

One of the major challenges in OA initiatives is that universities use a long and bureaucratic decision-making process, especially related to institutional OA policy. Some universities have been waiting for approval of their proposed OA policies for more than ten years, even though they are members of CEARL. The lack of approved institutional OA policy in some universities hinder the opening of their IR to the world, even though national OA policy mandates that OA shall be the default for research dissemination.

Awareness and Skill

CEARL, HESC and EthERNet have been conducting various training and workshops on OA targeting research leaders, librarians, editors, researchers and publishers to increase their awareness and skills. However, the dynamics of open science, staff turnover, and the emergence of new universities requires academic leaders, librarians, and researchers who need continuous capacity building training on OA.

Opportunities

The successes of OA initiatives in Ethiopia are the result of enabling opportunities with different stakeholders including MoSHE, CEARL and international partners.

Support from the Ministry

MoSHE through EthERNet has been supporting OA initiatives across Ethiopia by contributing policy support, capacity building, and infrastructure development resources. The Ministry adopted a national OA policy to enable the implementation of opening research to the public, which was a great opportunity for universities and research institutions in Ethiopia. In addition, the ministry provides infrastructure support in the form of software and training for HLIs to implement IRs and host OA journals.

Local and International Collaboration

CEARL is the first support centre to start OA initiatives. The consortium provides expertise for any OA project from its members who are located in different universities and research libraries. CEARL also connects libraries with its local partners including MoSHE, EthERNet, HESC, and others to get support on OA issues. Internationally, CEARL collaborates with Electronic Information for Libraries (EIFL), LIBSENSE initiative, and Directory of Open Access Journals (DOAJ), all of which create opportunities for members to take advantage of international expertise and learn best open science practices.

FUTURE RESEARCH DIRECTIONS

It is important to showcase the impact of openness in quality of Education to push the agenda of open access further in Ethiopia. Thus, one of the areas of future research might be assessing the impact of open access for quality of Education. In addition, different mechanisms of impact assessment matrix need to be explored so as to propose appropriate matrix for research assessment for open research. Ethiopia

is at the start of opening research data which is a new phenomenon so there a need to make readiness assessment for open research data which can also be one area of future research. Moreover, studying the knowledge sharing behavior of researchers will be useful to develop open access strategies and it should be researched further.

CONCLUSION

Scholarly communication and knowledge dissemination practices have changed over time. In the time and age we live in, open access plays a huge role in addressing inequities as well as broad-based and inclusive scientific progresses. Apparently, the COVID-19 pandemic highlighted the importance of transparency and reminded us of the importance of open and timely access to information so as to accelerate advances in finding solutions to societal issues in general.

This chapter presented the status of open access initiatives in Ethiopia with the associated challenges and opportunities. Despite the slow start, there is a significant progress with open access initiatives in Ethiopia, ranging from development of national and institutional OA policies to implementation of national and institutional repositories and to the implementation of national open access Journals platform to publish local journals online. The contribution of open access article in gold open access journals by Ethiopian authors is also increasing significantly. The success stories are the results of strong collaboration among various stakeholders, including CEARL, AAU, MoSHE, and HESC locally with our international partner EIFL. Although there are still resistance and skepticism like everywhere else, increasingly local OA Champions (researchers, librarians, and policy makers) joining the bandwagon and contributed a lot to the success of the OA initiatives. The fact that the OA initiatives in Ethiopia have been driven by local OA Champions should help for the sustainability of the initiatives.

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KEY TERMS AND DEFINITIONS

Consortium of Ethiopian Academic and Research Libraries (CEARL): CEARL is an Ethiopian library and research institute consortium that aims to assist and facilitate information access and use in Ethiopian higher learning and research institutes.

Creative Commons (CC): A nonprofit organization that offers freely available copyright licenses that provide a standard way to give the public permission to share and use scholarly work, under conditions of creator's choice. Different licences allow a different degree of openness. The CC BY 4.0, for example, requires attribution of the author and is recommended for open scientific publications.

EthERNet: Refers to academic and research network of Ethiopia mainly focusing on technology infrastructure.

Ethiopian Academy of Sciences (EAS): EAS is a merit-based society of prominent scholars who wish to promote the sciences and bring about development, prosperity and improved health for the people of Ethiopia. The Academy was established on 27 March 2010 by forty-nine Founding Fellows elected by the scientific community. The Academy aims to advance the development of all the sciences, including the natural sciences, mathematics, the health sciences, agricultural sciences, engineering, social sciences and humanities, fine arts and letters.

Ethiopian Journals Online: Is a national journal publications platform for open access journals in Ethiopia.

Ethiopian Ministry of Science and Higher Education (MoSHE): The Ministry of Science and Higher Education (MoSHE), established by proclamation number 1097/2018 in October 2018, is responsible to lead the development of science, higher education as well as the technical and vocational education and training (TVET) in Ethiopia.

Gold Open Access: Refers to the Gold route to open access and is delivered via publishing an article in a journal.

Institutional Repository (IR): Is a set of services that a university offers to the members of its community for the management and dissemination of digital materials created by the institution and its community members. It includes an organization's commitment to the stewardship of digital materials, including long-term preservation where appropriate, as well as organization and access.

National Academic Digital Repository of Ethiopia (NADRE): Is aggregated national repository for Ethiopia which is established to make open access to research works published by Ethiopian Universities and research intuitions.

Predatory Publishers: Publishers who offer open access for a charge but whose quality and services do not meet the standards set for scientific publications.

Research Data: Is any information that has been collected, observed, generated or created to validate original research findings (such as raw data captured from instruments sensors, visualizations, models, algorithms, images, audio and video files, etc.).

Chapter 3
OAI in University Libraries:
Its Dynamics in India's Northeast

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ABSTRACT

Open access initiatives (OAI) have gained momentum and have been accepted by the academic communities of the world. The role of libraries in promoting open access culture in universities is much more crucial in many ways. In the present study, the university library system in Northeast India has been assessed about the OAI taken up by them. The same has enabled the authors to ascertain many clues of the university systems, services, facilities, establishment of institutional repositories, supporting open access publications, conducting advocacy programs, and many others as a sign of engagement in this movement. The findings of the study have shown that almost 90% of the university libraries of the region have supported the open access movement and some of the universities have also started to establish digital institutional repositories using DSpace software.

BACKGROUND

Open Access (OA), as we consider today, is an approach to the online availability of research articles immediately and instantly free from most of the copyright and licensing terms without any charge in the digital environment. Two decades-old OA movement since the Budapest Open Access Initiatives (BOAI) declaration made in 2002 is considered as the origin of this very recent concept even though it was conceived in the 1990s with the emergence of the WWW. This movement has become a global issue that it is critical for all involved in scholarly publishing, including policymakers, research funders, learned societies, publishers, governments, librarians, and academic communities, to be well-informed

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on the history, benefits, and pitfalls of Open Access (Tennant, et al., *2016)*. The concept of OA first captured the attention of the scientific and scholarly research community, bringing with it the promise and potential of a shining new digital landscape, in which knowledge is freely shared and freely used, and the pace of scientific discovery is accelerated for the benefit of all (Joseph, 2013). However, today the movement has been strengthened to include data, code, open educational resources and other research products. OA now comes in different flavours green, gold, diamond or platinum, and black. It has the potential to empower and stimulate ordinary people to be more intellectually inventive, providing many benefits in terms of their visibility, wider access and increased citation to the researchers and institutions; funders invested their funds to ensure returning better research results that have widely acceptable and usable by the industry or society. Libraries, particularly academic libraries, have a vested interest in supporting open access due to certain reasons. They have been facing, since the past few decades, serial crisis, shrinking budgets, publishers big deal policy, etc. Connecting the people with vast information being the fundamental objectives of libraries, the goals of OA make librarians a natural advocate for promoting greater access to scholarly works. Librarians have been involving in advocating OA related issues such as author rights, open access funding mechanisms, negotiation of open access agreements with major publishers, public access mandates, promoting the use of institutional repositories, and, most recently, using publication metrics and other indicators to analyse the impact of research. Hence, OA brings libraries closer to the scholarly communication process and their relationships with publishers and authors, and the dissemination of information. In this context, the role of the university library system is very great. The websites of the universities nowadays feature many provisions for OA towards enhancement of the digital marketing of the library products and services to a wider perspective. This chapter attempts to highlight the provisions made by the universities of different types having different ownership in India's North East about their initiatives taken up towards having Open Access through assessing their websites and by conducting a case study of the selected universities of the region.

LITERATURE REVIEW

Review of related literature has made us understood about the fast growing trends of research in OAI at global level and India as well.

Global Perspectives

Studies on open access initiatives have been conducted in different parts of the world. The SHERPA initiative (https://www.sherpa.ac.uk/) in the United Kingdom supports and encourages the creation of digital repositories in UK universities. Recent studies conducted by the Joint Information Systems Committee (JISC), have found that OA could improve the scholarly communication system. According to the JISC (2009) conclusions, switching to an OA publishing system will save British universities roughly £80 million per year. Richard,et al.,(2009) reflecting on the experiences of academic librarians involved in OA in Canada, noted that librarians are active participants in the OA movement. Librarians participate by adding OA titles to their collections, educating academic staff and promoting the values of OA. In addition, librarians support OA standards for publishing and digitizing their historical collections. Thus, the chief role of librarians is to advocate for OA. Van Orsdel & Born (2009) suggested that publishers, in general, are not attempting to satisfy the increased demand for OA. In Asia-Oceania region, the OA

movement rapidly grew because of the vibrant economies that require a solid research base. According to Elahi & Mezbah-ul-Islam (2018, 132–142), the OA movement in Bangladesh gained traction due to the necessity to overcome library budgetary limits for journal subscriptions. To encourage the free movement of information and knowledge practices, the authors advised academic institutions to build Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) compatible OA repositories. In Zimbabwe, the principal shape of OA expression is the institutional repository (IR), followed by the OA journal (Nyambi & Maynard, 2012). Furthermore, OA initiatives should be analysed in the context of copyright laws with reference to public domain works. Intellectual property rights and copyright should be interpreted in the context of utilitarian and natural rights philosophies (Scheufen, 2015). Open access initiatives in Pakistan seems to be slow despite the focus by the Higher Education Councils of Pakistan on the importance of open access in research to achieve a range of socio-economic goals of the nation. Pakistan has done little to leverage the comprehensive benefits of open access to bolster national strategies (Sheikh, 2020). Among the South Asian countries, China and India lead the developing world in open access movement and publishing scholarly literature (Nashipudi & Ravi, 2014).

Indian Perspectives

In India, research and development organizations, government funding agencies, scientific institutions, learned societies, publishers, and associations have taken positive measures to support open access publishing. National institutions like CSIR, DBST, INFLIBNET and the National Knowledge Commission formulated policies and programmes to support easy access to research through its open and broader dissemination (Shah, et al., 2014). Science-Central, India's centralised hosting service, collects data from all 42 institutional repositories of the Department of Science and Technology (DST) and the Department of Biotechnology (DBT) to promote open access to publications from DST and DBT-funded projects (Naika & Pathak, 2020a). Based on country-by-country examination of publications and publication models in Web of Science indicated that, while India ranked 10th in overall research production and 8th in research output following the gold OA model globally, it placed third in OA journal publications. The number of Indian articles published in open access journals was 2% greater than the global average (Nazim, 2018). However, according to Scopus data, India ranks sixth in the world in terms of open access articles, behind the United States, China, the United Kingdom, Germany, and Japan, appears to be making a substantial contribution to open access publishing (Piwowar, et al., 2018).

According to government sources, India's new science policy, Science, Technology and Innovation Policy 2020, has recommended a "one nation, one subscription" formula to replace the current practise of individual academic institutes or consortia of institutes subscribing to journals separately, thereby duplicating costs (Naika & Pathak, 2020b). In her recent publications, Sofia (2021) has analytically discussed the OAI in university libraries focusing on such universities of North East India.

INDIA'S NORTH EAST

India's North East comprises of eight states: Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura covering 8% of the country's land area. A region renowned for its bewildering diversity and magical beauty is the home of around 166 separate tribes speaking a wide range of languages and dialects.

The following *Table 1* gives the background information about North East India.

The region is considered as one of India's backward areas, with low per capita income, low capital creation, lack of private investment, insufficient infrastructure, geographical isolation, and insufficient use of mineral resources, hydropower potential, and biodiversity. Despite its majestic natural beauty, immense natural resources and also a vantage entry point for the Southeast Asian markets, it is one of India's most conflict zones, having insurgency problems, drug abuse, violation of human rights issues that have been affecting the youths and education system of the region.

Table 1. North East India at a glance

State	Capital	Population (2011)	Area	Language	Literacy Rate
Arunachal Pradesh	Itanagar	1,382,611	83,743 km^2	Hindi, English	66.95%
Assam	Dispur	31,205,576	78,438 km^2	Assamese, Bodo, Bengali	72.19%
Manipur	Imphal	2,855,794	22,327 km^2	Meiteilon, Manipuri, Tribal Dialects, English, Hindi	79.85%
Meghalaya	Shillong	3,211,000	22,429 km^2	English	75.84%
Mizoram	Aizawl	1,091,014	21,087 km^2	Mizo, English	91.58%
Nagaland	Kohima	1,980,602	16,579 km^2	English	80.11%
Sikkim	Gangtok	610,577	7,096 km^2	Nepali, English	82.6%
Tripura	Agartala	3,671,032	10,491.69 km^2	Bengali, Kokborok	87.75%

UNIVERSITIES IN NORTH EAST INDIA

There are a total of 71 universities in North East India of which Assam tops the list with 26 universities comprising of 2 central, 17 state, 1 deemed and 6 private universities, followed by Manipur and Arunachal Pradesh with 10 universities each. While Meghalaya is having 9 universities, as table-2 shows, rest of the states are found to have 6, 5, 3, and 2 universities in respect of Sikkim, Nagaland, Tripura and Mizoram respectively. Manipur has maximum number of central universities (3 in numbers) followed by Assam with 2 universities while rest of the six states has one central University each. There are no state universities in respect of Meghalaya, Arunachal Pradesh, Mizoram and Nagaland. Except in Assam and Arunachal Pradesh, no deemed universities are there in the region. The growth rate of private universities is high in Meghalaya and Arunachal Pradesh, followed by Manipur, Nagaland and Sikkim but least in case of Mizoram and Tripura.

OBJECTIVES OF THE STUDY

The study has been undertaken

- To have an overview of the university systems in North East India.
- To assess the provision made by them to render OA facilities through their libraries.

Table 2. University systems in the region

Sl. No.	State	Central	State	Deemed	Private	Total
1.	Assam	2	17	1	6	26
2.	Manipur	3	3	0	4	10
3.	Meghalaya	1	0	0	8	9
4.	Arunachal Pradesh	1	0	1	8	10
5.	Mizoram	1	0	0	1	2
6.	Nagaland	1	0	0	4	5
7.	Sikkim	1	1	0	4	6
8.	Tripura	1	1	0	1	3
	Total	11	22	2	36	71

- To evaluate the websites of the universities if they feature any provisions for OA.
- To ascertain how is the OA provisions of the libraries.
- To conduct a case study on some selected universities to get clear perspectives.
- To evaluate the current status of OAI taken up by them.

SCOPE AND METHODOLOGY

The study has been taken up based on the related literature and evaluating the website of Universities focusing on their libraries regarding their initiatives towards open access. Based on a pilot survey conducted covering 71 universities in the region, only 29 of them have their library websites. Through their websites, various aspects of the universities have been evaluated on their initiatives towards open access movement particularly. To have a clear picture of the OA provision, a case study has been undertaken on selected 20 libraries consisting of 11(55%) Central University library, 5(25%) State University Library and 4 (20%) Private University Library. A semi structurally designed questionnaire has been used to collect data from the university libraries under study.

RESEARCH HYPOTHESES

The study has formulated the following three hypotheses for testing their validity towards meeting the set objectives:

Hypothesis I : *There are different possible motives that significantly influence the University Libraries in developing Open Access Initiatives (OAI).*

Hypothesis–II: *Advocacy programme, Institutional repository and OA publishing significantly support the OAI*

Hypothesis III: *OAI have a direct impact on budget, collection development, vendor, publishers and users of the library system*

OPEN ACCESS INITIATIVES

The Open Access Initiatives (OAI) in the Universities of the region are being discussed under two aspects

- Assessment through websites
- Case Study

ASSESSMENT THROUGH WEBSITES

Library websites are libraries' virtual presentations to the world. They serve as a gateway to their online catalogues, electronic databases, digital collections and interactive space in the digital environment. Nowadays, users visit more often library websites than they visit physically to the libraries. Therefore, these digital spaces should be compelling, engaging, current and easily navigable. Despite providing considerably high-quality scholarly information, most library websites face stiff competition in user preference with new searching and sharing tools such as Google, Amazon, YouTube, etc. (Liu, 2008). Therefore, libraries need to follow the guidelines while designing the website based on the demand of the users, the content of the websites, different formats, user engagement, personalization, online community, functional design, intuitive navigation, fast loading speed and regular updates. The evaluation of website of the universities under study can provide us many aspects of the OA movement in the region.

The Websites

The 29 universities of the region comprising of 10 central universities,14 State universities and 5 private universities are found to have their library websites. Based on these websites, the current status of libraries concerning their services, accessibility to their resources, enhanced features and particularly initiatives towards open access initiatives can be understood. The websites of these selected universities under consideration are given below:

Arunachal Pradesh

Central Universities:

1. *Rajiv Gandhi University (RGU)(*http://www.rgu.ac.in*)*

Private Universities:

2. *Arunachal University of Studies (AUS) (*http://www.arunachaluniversity.ac.in.*)*

Assam

Central Universities*:*

3. *Assam University (AU) (*http://www.aus.ac.in*)*

4. *Tezpur University (TEZU)(*http://www.tezu.ernet.in*)*

State Universities:

5. *Assam Agricultural University (AAU) (*http://www.aau.ac.in*)*
6. *Bhattadev University (BHU) (*https://www.bhattadevuniversity.ac.in/*)*
7. *Bodoland University (BU) (*http://www.bodolanduniversity.ac.in*)*
8. *Cotton University (CU) (*https://cottonuniversity.ac.in/*)*
9. *Dibrugarh University (DBU) (*http://www.dibru.ac.in*)*
10. *Gauhati University (GU) (*http://www.gauhati.ac.in*)*
11. *Krishna Kanta Handique State Open University (KKHSOU) (*http://www.kkhsou.in*)*
12. *Kumar BhaskarVarma Sanskrit & Ancient Studies University (KBVSASU) (*http://www.kbvsasun.ac.in*)*
13. *National Law University and Judicial Academy (NLUJA) (*http://www.nluassam.ac.in/*)*
14. *Rabindranath Tagore University (RTU) (*https://rtuassam.ac.in/*)*

Private Universities:

15. *Assam Don Bosco University (ADBU) (*http://www.vou.ac.in*)*

Manipur

Central Universities:

16. *Manipur University (MU) (*https:www.manipuruniv.ac.in*).*
17. *National Sports University (*https://www.nsu.ac.in/*)*

State Universities:

18. *Dhanamanjuri University (DMU) (*http://dmu.ac.in*)*
19. *Manipur Technical University (MTU) (* http://mtu.ac.in*)*
20. *Manipur University of Culture (MUC) (*http://muc.ac.in*)*

Meghalaya

Central Universities:

21. *North Eastern Hill University (NEHU) (*http://nehu.ac.in*)*

Private Universities:

22. *University of Science & Technology, Meghalaya (USTM)(*www.ustm.ac.in*)*

Mizoram

Central Universities:

23. *Mizoram University (MZU) (*http://www.mzu.ac.in*)*

Private Universities:

24. *ICFAI, Mizoram (ICFAI) (*https://www.iumizoram.edu.in/*)*

Nagaland

Central Universities:

25. *Nagaland University (NU) (*https://nagalanduniversity.ac.in/*)*

Sikkim

Central Universities:

26. *Sikkim University (*https://cus.ac.in/index.php/en/*)*

Private Universities:

27. *Shri Ramasamy Memorial University, Sikkim (SRMU) (*https://www.srmus.ac.in/*)*

Tripura

Central Universities:

28. *Tripura University (TU) (*https://www.tripurauniv.ac.in/*)*

State Universities:

29. *Maharaja Bir Bikram University (MBBU) (*https://mbbuniversity.ac.in/*)*

Contents of the Websites

The websites of these universities have provided different contents related to library and provisions for open access as discussed below:

Library Services

Concerning the library services, most of the libraries of the region have provided circulation up to (62. 06%), OPAC (51.72%), reference service (44.82%), CAS/SDI, reprography, user orientation/ information literacy services and Web OPAC up to (37.93%). Concerning digital reference service, 24.13% of the universities provide features like Ask a librarian, FAQ, Feed Back form, etc. Rajiv Gandhi University, Mizoram University and Nagaland University have RFID facilities for smooth functioning of the circulation and theft detection while 55.17% of the universities have Wi Fi/e-mail service. Govt. Publications portal is seen in respect of Cotton University, Dibrugarh University, Gauhati University, Tezpur University, NEHU and Tripura University. Few of the universities have library e-newsletter, newspaper clipping, bound periodical/volumes and online document delivery services. Cotton University, Dibrugarh University, Gauhati University, Tripura University and Maharaja Bir Bikram University have special collections on the literature of North East India and eminent personalities of the region. In Gauhati University, there is a digital archive for Dr Bhupen Hazarika, the renowned playback singer, lyricist, musician, poet and filmmaker of Assam. As a research support service, Plagiarism checker tools, Citation managers, VIDWAN database, IRINS, Copyright/ IPR information service have been identified in some of the libraries. In some universities, advanced searching tools like Federated search and web discovery tools have been used. Web 2.0 / Library 2.0 features like RSS Feed, Twitter, Facebook page, YouTube, blogs, Google +, etc. are found to appear in 37.93% universities. Tezpur University, Assam is the only university library having QR Code, while NEHU and Tezpur University are having Audio Video/ Microform services. Disability support service like braille books, audio books, audio recording of text books are featured in respect of Cotton University, Dibrugarh University, Kumar Bhaskar Varma Sanskrit & Ancient Studies University, Tezpur University and Mizoram University. Provisions for remote access to e – resources are found in six universities. Other services such as reading list / bibliography, CCTV, printing/ binding/ scanning, online catalogue/ directories/databases are also seen in some of the libraries.

Accessibility to E- Resources

Among the university libraries under study, KOHA and SOUL.2.0 are mostly used as the library management software. Concerning the availability of e-resources, INFLIBNET is seen as the primary service provider in the region. It is observed that 44.82% of the universities subscribe to INFLIBNET services such as E-ShodhShidhu, N-LIST, ShodhGanga, Infoport as subject directory, world e-Book Library and DBT e-Library Consortium (DeLCON), Electronic Journal Consortium, through which they get maximum e- books, e- journals and other e – resources. NEHU library website has links to good source of subject information gateways in their websites. Assam Agricultural University is found to be participated in Krishi Kosh, Delcon consortium and CeRa, the Indian Council of Agricultural Research's e-Consortium of Agricultural Libraries, for the National Agricultural Research and Education System (NARES) Libraries. Cotton University, Tezpur University and Sikkim University provide e- resources under DELNET membership. Besides the above licensed e- resources, most of the Universities have started digitization of their institutional collections like rare documents, thesis, special collections, manuscripts, etc. to make accessible to the user community.

Open Access E Journals

Concerning open access journals, Nagaland University, Dibrugarh University, Tezpur University, Mizoram University, NEHU, Bodoland University and Krishna Kanta Handiqui Open State University provide links for the same in their library Portal. Nagaland university listed more than 40 open access journals or open access directories, among them DOAJ (Directory of Open Access Journal) is identified as the most cited one in most of the libraries followed by BioMed Central, PubMed, Science Direct OAJ, Springer Direct OAJ, Taylor &Francies, Intech Open Access Journals, Oxford Academy, NISCAIR online periodicals, etc.

Open Access E Books

In this regard, Nagaland University, Mizoram University, Tezpur University, Dibrugrah University, NEHU, Rajiv Gandhi University are found to cite most OA Book directories in their websites. Project Gutenberg, PDF Drive, Hathi Trust, Intech Open Access Book, Free Online Books, Directory of open Access Books (DOAB), Bookfi, Open Suny Text books, Open Textbooks, Project Muse, Jstor, ICAR publications, etc. are found to be the most listed sites.

Digital Libraries

More than 62% of the universities have registered to National Digital Library of India, a project of the Indian government's Ministry of Education with the aim to collect and collate metadata from a variety of national and international digital libraries, as well as other relevant sources, and to create a full text index. This digital library houses textbooks, articles, films, audio books, lectures, simulations, fiction, and other forms of educational contents offering a variety of services free of cost access to many books in English and other Indian languages (Wikipedia, 2022). NDLI also helps to build the libraries of the region particularly the newly established universities to provide maximum e- resources to their user community. Nagaland university, Tezpur university, NEHU have listed more digital library links such as world e- Book Library, Traditional Knowledge Library (TKL) of CSIR, World Digital Library, e-Ghyankosh, Cambridge Digital Library, etc.

Electronic Thesis and Dissertation (ETD)

Electronic Theses and Dissertations (ETDs) are becoming one of the important parts of digital collections. They acquire maximum visibility. Since 1996, the Networked Digital Library of Electronic Theses and Dissertations (NDLTD) has gathered support from a number of international and American colleges and universities. It provides assistance in publishing and open access to scholarship in order to enhance the sharing and preservation of knowledge worldwide (Edminster, 2002). India's INFLIBNET had developed an online repository of ETDs known as Shodhganga which is considered as the most trusted ETDs repository of universities in India. Most of the Universities under study also have been benefited from the Shodhganga ETD. Using DSpace open source software, 38.9% of the universities of the region have their own Institutional repositories serving as a repository of intellectual outputs including theses and dissertations, seminar publications, class lectures, technical reports, monograph, etc. and make it accessible to the entire scholarly community worldwide for open access. Dhanamanjuri University,

has registered to IR@ INFLIBNET. In addition, Nagaland University, Dibrugarh University, Tezpur University, Mizoram University have provided various open access ETD links including DART-Europe E- Theses, Ethos-UK, NDLTD, OATD, American Doctoral Dissertation, DRTC Librarians Digital Library, Vidyanidhi, CSIR Exploration, etc. in their library websites.

OER/ MOOCs

Massive Open Online courses (MOOCs) is framed as a reflection of the need for universities to change and as a way of pushing a new perspective on digital teaching and learning methods (Lewin, 2013; Pappano, 2012). Irvine, et al. (2013), position MOOCs in a broader landscape of increasing learning opportunities for learners from anywhere and anytime from multiple access points. MOOCs are expected to witness a phenomenal growth in student registration in coming future due to its flexibility. University libraries of the region have shown a great effort in promoting OER/ MOOCs in their websites. SWAWAM, SWAYAM Prabha, NPTEL, e-PG Pathshala, Vidhya –Mitra, Spoken Tutorial, CEC, NMEICT, MIT OC, Khan Academy, Open 2study, Coursera, edx.org, etc. are the major MOOCs programs providing links by most of the universities of the region.

Key Findings

Assessment of the websites has found that universities of the region particularly the central universities namely Tezpur University, NEHU, Nagaland University, Mizoram University and Sikkim University have must facilities with advanced services. They have also shown more engagement in open access movement in the region. Among the state-run universities, Dibrugarh University, Cotton University and in case of private University, Assam Don Bosco University, Assam and USTM, Meghalaya have taken up major initiatives by establishing Institutional Repositories and promoting open access resources. However, the study could not trace any clue on supporting open access publishing and about any advocacy programmes on open access in libraries under study. To provide an in- depth analysis on the issue, a case study has been conducted on some selected universities of the region

CASE STUDY

A case study on 20 selected university libraries comprising of 11central universities, 5 state universities and 4 private universities has been conducted to get a clear perspective on the OAI as given below:
The 11Central Universities covered include:

Rajiv Gandhi University (RGU), Arunachal Pradesh; Assam University (AU), Silchar, Assam; Tezpur University (TEZU), Tezpur, Assam; Manipur University (MU), Imphal, Manipur; Central Agricultural University (CAU), Imphal, Manipur; IGNTU, Imphal, Manipur; North Eastern Hill University (NEHU), Shillong, Meghalaya; Mizoram University (MZU), Aizwal, Mizoram; Nagaland University (NU), Kohima, Nagaland; Sikkim University (SU), Sikkim; Tripura University (TU), Tripura.

The five State Universities covered are:

Assam Agricultural University (AAU), Jorhat, Assam; Dibrugarh University (DBU), Dibrugarh, Assam; Gauhati University (GU), Assam; Boroland University (BU), Assam; Krishna Kanta Handiqui Open State University (KKHOSU), Assam

The following is the 4 Private Universities considered for the study**:**

Assam Don Bosco University (ADBU), Assam; Martin Luther Christian University (MLCU), Meghalaya; Sikkim Manipal University (SMU), Sikkim; SRM University, Sikkim.

ANALYSIS OF DATA

Analysis of the data has shown us many clues on the initiatives taken up by the university libraries under study on OAI under different aspects:

On Common Motives

The common Motives behind adoption of OAI by the university libraries in the region are understood from the *Table 3* below:

The above table represents the level of likeliness towards various possible motives behind OAI. As observed, most of the libraries give positive motives to the role of "serial crisis" behind OAI. Only 11.11% library gives neutral to the role of "serial crisis" behind OAI. From the one-sample chi-square

Table 3. Motives towards OAI n=20

Motives	Response rate			One-sample Chi-square test (P-value)
	Very Likely (%)	Likely (%)	Neutral (%)	
Serial Crisis	5 (27.78)	11 (61.11)	2 (11.11)	7.00 (0.03)
Immediate access to the literature	15 (83.33)	3 (16.67)	-	8.00 (<0.001)
Removes price and access barriers	10 (55.56)	7 (38.89)	1 (5.56)	7.00 (0.03)
Free from most of copyright & licensing fee	5 (27.78)	12 (66.67)	1 (5.56)	10.333 (0.006)
Open access journal is compatible with peer review	8 (44.44)	6 (33.33)	4 (22.22)	1.333 (0.513)
Increase visibility and impact of reserve output of the institution	8 (44.44)	6 (33.33)	4 (22.22)	1.333 (0.513)
Enrich library collection	14.0 (77.78)	3.0 (16.67)	1.0 (5.56)	16.3 (<0.001)
OA acts as a key driven for scientific productivity	7 (38.89)	10 (55.56)	1 (5.56)	7.00 (0.03)
OA acts as a key element of the research infrastructure	8 (44.44)	10 (55.56)	-	0.222 (0.637)
OA helps users to find the information	8.0 (44.44)	10.0 (55.56)	-	0.222 (0.637)
OA institutional repository will become the preservation centre	11.0 (61.11)	7.0 (38.89)	-	0.889 (0.346)

test result, it is found to be statistically significant with P-value = 0.03 at 5% level of significant. Thus, it can be concluded that the level of likeliness to the possible motive on serial crisis behind OAI among the libraries under study are not same. Majority of the libraries 83.33% prefer maximum likeliness on "Immediate access to the literature" followed by likely attitude with a 16.67% [$\chi 2\ (2) = 8.00$, P=<0.001].

More than half of the libraries 55.56% prefer very likeliness to the motive "Removes price and access barriers" followed by likeliness by (5.56%) and only 5.56% neutral attitude. From the significant test, it is found to be statistically significant with p-value = 0.03. Thus, there is variation among the libraries regarding the likeliness of the motive "Removes price and access barriers". Similarly, statistically significant results are found to the possible motives "Free from most of copyright & licensing fee" and "Enrich library collection". As such, most of the libraries prefer likeliness to the different possible motives behind OAI.

Supporting OAI

The different possible measures taken up by the libraries concerning OAI in the Universities are being discussed here. The following *Table 4*. indicates the responses toward this issue.

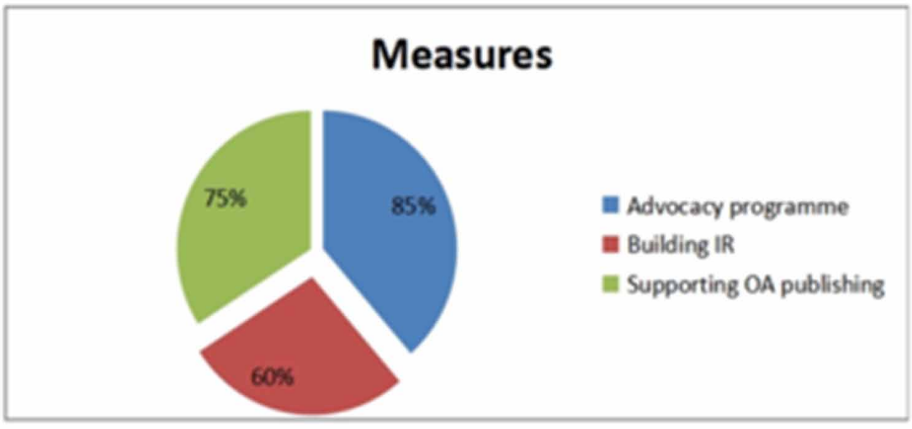
It is seen that 85% university libraries have conducted advocacy programme to support OAI in their respective universities while 60% universities have already started to establish IR and 75% have supported OA publishing. Assam Agricultural University, Jorhat, Dibrugarh University, Dibrugarh, Assam,

Table 4. Possible measures n=20

Options	Response	Response Rate
Advocacy programme	17	85%
Building IR	12	60%
Supporting OA publishing	15	75%

Tezpur University, Tezpur, Assam, North Eastern Hill University, Shillong, Meghalaya, Sikkim University Gangtok, Sikkim, Central Agricultural University, Imphal, Manipur, Tripura University, Agartala, Tripura have supported all the three measures to promote OA.

Figure 1. Pie-chart showing the measures adopted by the university libraries



Advocacy as a Measure

Advocacy involves the process of communications, lobbying activities with marketing and public relations skills to increase the visibility to the user community and other stakeholders on open access initiatives programmes and policies. The advocacy theme is predominantly discussed in conference, seminars, workshops and discussion forums of the professionals. The different types of Advocacy Programmes that have been conducted at various level as a means to support OA in their libraries by the 17 Universities under study are of many as shown under *Table 5* below:

Table 5. Advocacy programmes n=17

Advocacy programmes	Response rate			One-sample Chi-square test	(P-value)
	To a great extent (%)	To some extent (%)	Not at all (%)		
Face to face advocacy programme	7.0 (41.18)	9.0 (52.94)	1.0 (5.88)	6.11	(0.047)
Discussion with faculty members authorities and scholars regarding existing problems of scholarly communication	11.0 (64.71)	6.0 (35.29)	0.00	1.471	(0.225)
Poster campaign in the library and the campus	5.0 (29.41)	5.0 (29.41)	7.0 (41.18)	0.471	(0.79)
Information on library websites	7.0 (41.18)	9.0 (52.94)	1.0 (5.88)	6.118	(0.047)
Organising conferences and seminars in various departments	12.0 (70.59)	4.0 (23.53)	1.0 (5.88)	11.412	(0.003)
Organising open Access week	4.0 (23.53)	3.0 (17.65)	10.0 (58.82)	5.059	(0.08)
Information session or full day symposia with experts	9.0 (52.94)	3.0 (17.65)	5.0 (29.41)	3.294	(0.193)
Publication of open Access journals and books of the university	10.0 (58.82)	5.0 (29.41)	2.0 (11.76)	5.765	(0.056)
Supporting and becoming membership in OA organisations	6.0 (35.29)	2.0 (11.76)	9.0 (52.94)	4.353	(0.113)

Building IR

The different aspects of the 12 Universities of the region in building IRs are shown under *Table 6* below:

Table 6. Towards building institutional repositories n= 12

Universities	Software used	Separate staff	Self–archiving policy		Metadata Harvester	OAI Compliant	Register to
			Optional	Mandatory			
AU	DSpace	No	Optional	–	N/A	N/A	N/A
ADBU	DSpace	No	Optional	–	No	No	No
DBU	DSpace	No	Optional	–	N/A	N/A	N/A
AAU	N/A	No	N/A	N/A	N/A	N/A	N/A
GU	DSpace	No	Optional	–	OAI-PMH	Yes	No
TEZU	DSpace	Yes	NA	NA	OAI-PMH	Yes	No
MU	DSpace	No	N/A	N/A	N/A	N/A	N/A
CAU	N/A	No	Optional	–	OAI-PMH	No	No
NEHU	DSpace	Yes	Optional	–	OAI-PMH	Yes	National Digital Library
MZU	DSpace	No	Optional	–	N/A	N/A	N/A
SU	DSpace	No	Optional	–	OAI-PMH	Yes	DOAR
TU	DSpace	No	Optional	–	OAI-PMH	Yes	No

It is observed that DSpace is the only software used for building IRs by the libraries 83.33%, but only 16.66% of them have separate staff for building such repositories that is NEHU Shillong and Tezpur University, Assam. Of the 12 universities, 75% consider self-archiving policy as "optional". Concerning "metadata harvester", OAI-PMH is found to be used in 50% universities, while the rest do not use any such model. Of the 12 Universities, only 50% responded their IRs as "OAI Compliant". It is also understood that, the IRs of NEHU and Sikkim University are registered to National Digital Library and DOAR respectively.

Supporting OA Publishing

Among the 20 Universities, 15 are supporting open access publishing through open access journals, open access books, or open courseware as the *Table 7* shows:

Table 7. Supporting OA publishing n=15

Options	Yes	No
OA Journals	15 (100%)	0 (0%)
OA Books	12 (80%)	3 (20%)
Open Course Ware	4(26.66%)	11 (73.33%)

It is observed that, all the 15 Universities supporting OA publishing have "100% OA Journals" while 80% of them supporting OA Books and only 26.66% of them have supported Open Course Ware Options.

Impact of OAI

OAI have a direct impact on various aspects such in library budget, collection development, vendor/ supplier, publishers, users of the library systems as the following Table 8 indicates us.

Table 8. Impact of OA n=20

Impact of OAI	Response	No. of Library	%	Chi-square	P-value
Library Budget	Yes	14	70.00	3.2	0.074
	No	6	30.00		
Collection development	Yes	19	95.00	16.2	<0.001
	No	1	5.00		
Vendor/Supplier	Yes	11	55.00	0.2	0.655
	No	9	45.00		
Publisher	Yes	13	65.00	1.8	0.18
	No	7	35.00		
Readers of the library system	Yes	17	85.00	9.8	0.002
	No	3	15.00		

The above table represents impact of OAI on various aspects such as library budget, collection development, vendor/supplier, publisher and readers. Out of 20 libraries under study 70% libraries accept that library budget has direct impact on OAI and remaining (30%). No statistically significant result is found within the libraries based on OAI which have direct impact on library budget. Majority of the libraries 95% significantly agree to the statement OAI have direct impact on collection development ($\chi 2=16.2$, P=<0.001). No statistically significant result is observed within the libraries based on vendor/supplier, publisher having direct impact to OAI. Whereas 85% libraries support to the statement OAI have direct impact on reader access to print library resources and it is found to be statistically significant; ($\chi^2=9.8$, P=0.002). From these we can conclude that most of the libraries prefer to collection development and reader access to print library resources.

DISCUSSION AND CONCLUSION

Most of the universities have websites to marketise their information services and products and made provisions for OA under certain aspects. But there are differences among the university systems in this regard. The websites need to be restructured and improved upon in many ways. The open access movement addresses numerous issues concerning serial crisis, research gap, accessibility, publisher's policy and other such barriers. Libraries of this particular region has limited resources in terms of collections,

infrastructure or manpower as compare to mainland. Open access movement presents an opportunity to the libraries of the region by extending their collections and services to the user community. Open Access (OA) resources can be an important part of libraries' strategies to maximize the value of their collections and can make aware the availability of Open access resources through the inclusion of such resources in the bibliographic databases, OPAC and discovery search tools that library patrons use to find scholarly information. OA resources can be OA Journals, OA Books, Digital Libraries, openly accessible Digital Institutional repositories and many more. University libraries of this region have shown a positive measure through providing link to various open access resources to their respective websites. Most of the libraries have initiated promoting open learning courses/ MOOCs and Institutional repository in their universities as a sign of involvement in open access movement.

The major findings of the case study have shown us many aspects on the OAI taken up by the universities through their libraries. It is remarkable that 90%of the university Libraries have supported OA in their respective Universities in the region. Among the various reasons for supporting open access, immediate access to the resources, enrich library collections, free from copyright and other restrictions, etc. have been identified. DSpace IR software being the most used software for IRs in the regions. There are different views regarding adoption of OAI in libraries. 95 percent of the Universities have opined that OAI have greatest impact on collection development followed by readers access to printed resources (85%), library budget (70%) and publishers (65%). Universities have been using library website and library catalogue as major means to reaching out OA resources to the users followed by DOAJ, Open JGate and Google Scholars, etc. The study has shown that centrally funded universities have much facilities and services to some extent as compare to state run and privately own universities. They are also taking major initiatives in this OA movement by establishing Institutional Repository and promoting open access resources. Most of the universities have registered to the National Digital Library of India (NDLI), Indian Digital Repository, initiated by IIT Kharagpur, under the aegis of the Ministry of Human Resource Development (MHRD), Government of India, where they get maximum open access resources to the universities of the region particularly to the newly established private universities. However, the study has revealed that, most of the universities of the region are in their initial stage and also facing lots of shortage concerning their resources, infrastructure and manpower. Obstacles to open access being misconception and lack of awareness, librarian must serve as intermediaries between user communities, digital resources and policy makers, advocating various issues on open access policy, open access mandates, open access publishing, funding policy and conducting open access awareness programme to the university community of the region. The main objective of library is to serve the user community in teaching, learning and research activity and goal of open access movement is making accessible to the vast scholarly literature producing from anywhere in the world without any price and access restriction. University of the region with limited resources in every aspect should take the opportunity of this open access movement to reach the global audience. In this regard, the university libraries in the region regardless of their types and ownership pattern need to go a long way towards having provision for OAI to serve the users community of the new open environment in the most effective ways.

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KEY TERMS AND DEFINITIONS

Institutional Repositories: An institutional repository is a digital storage services provided by an organisation or institution to its community members for the administration and dissemination of digital assets developed by the institution and its community members. It is mostly used as a commitment of the organisation to the long-term stewardship of these digital materials.

IRINS: Indian Research Information Network System is web-based Research Information Management (RIM) service provided by the Information and Library Network (INFLIBNET) Centre, An Inter-University Centre of University Grants Commission, Gandhinagar, Gujarat. IRINS has provided the unique features: import data from CSV and Bibtex formats; Import publications from academic Identities i.e. SCOPUS ID, Researcher ID, ORCID ID, Google Scholar ID and Microsoft Academic Search ID; Increased visibility of research output in terms of publications, citations and H-Index at individual, department, institutions and organisations level.; Data analytics such as productivity graph for the department, faculty and co-author network based on contributors; Automated ingestion to citation from SCOPUS, Crossref and Social media metrics from Altmetrics; Automated imbedding of metrics from google scholar; and Categorization of publications according to their publishing venue, Closed access, Green Open Access, Bronze OA and Gold Open Access.

MOOCs (Massive Open Online Courses): It is a model for delivering learning content in a large scale to any person who wants to take a course through the online mode.

North East India: Residing in the easternmost part of India, has international border with, Bangladesh, Bhutan, China, Nepal and Myanmar. It comprises of eight states namely Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura, Known for its rich biodiversity and famous for origin of polo, rainiest place in the world, floating national park in the world, and many more.

OER: Open Educational Resources (OER) are teaching, learning and research materials in any medium – digital or otherwise – that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions. OER form part of 'Open Solutions', alongside Free and Open Source Software (FOSS), Open Access (OA), Open Data (OD) and crowdsourcing platforms. (UNESCO).

Open Access Advocacy: An act to promote open access movement through building awareness on the benefits of open access and supporting open access publications in scholarly communication channels.

Open Access Initiatives (OAI): An initiative or an approach towards the availability of scholarly literatures to the public domain without any access, licence or geographical barrier through the internet.

Open Access Publishing: Publishing model in open access environment either in green, gold or diamond mode of publication as an alternative to subscription model with the aim to delivered scientific literature without any delayed to the public for the betterment of science and ultimately to the society.

SWAYAM: stands for Study Webs of Active Learning for Young Aspiring Minds, is a Government of India sponsored initiative aimed at achieving the three cardinal objectives of education policy: access, equity, and excellence. The goal of this initiative is to make the best teaching and learning tools available to everyone, especially the most disadvantaged. SWAYAM aims to close the digital divide for

students who have been left behind by the digital revolution and are unable to participate fully in the knowledge economy.

VIDWAN: Developed by Information and Library Network (INFLIBNET), a premier expert database of research profiles of scientist/researchers and faculty members working in leading academic institutions and research & Development organisations involved in teaching and research across India.

Chapter 4
The Struggle of Open Access Publishing:
The Indonesian Perspective

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ABSTRACT

Open access (OA) publishing has been in existence for almost 30 years. The development is not without barriers. So much effort has been needed to develop OA publishing, including OA books, OA repositories, OA journals, and open data repositories. Indonesia has been experiencing growth in OA publishing, especially in the last 10 years. To realize OA publishing requires much effort. Lack of understanding of OA, lack of OA policy, and contrasting views of OA have resulted in weak recognition of OA publishing. Further and more efforts are needed.

INTRODUCTION

The year of 1665 marked the beginning of scholarly communication with the introduction of a journal publication entitled Philosophical Transactions of the Royal Society. This was believed to be the first journal publication that applied peer-reviewing before publishing it. From that year, science has grown faster and scientists have shared their research findings more easily. Scholarly and scientific communication is an important part of academic life that plays a role in a system that creates, evaluates, disseminates, preserves, and reshapes new knowledge (Academic and Research Libraries (ARL), 2007; Cullen & Chawner, 2011; Kumar et al.,2011; Sawant, 2012).

However, since then, science has two different sides, one side is in the research itself within the academic and scientific world and the other is the commercial world of publishing research. Publishing has been a practice of business in the scientific world for many years.

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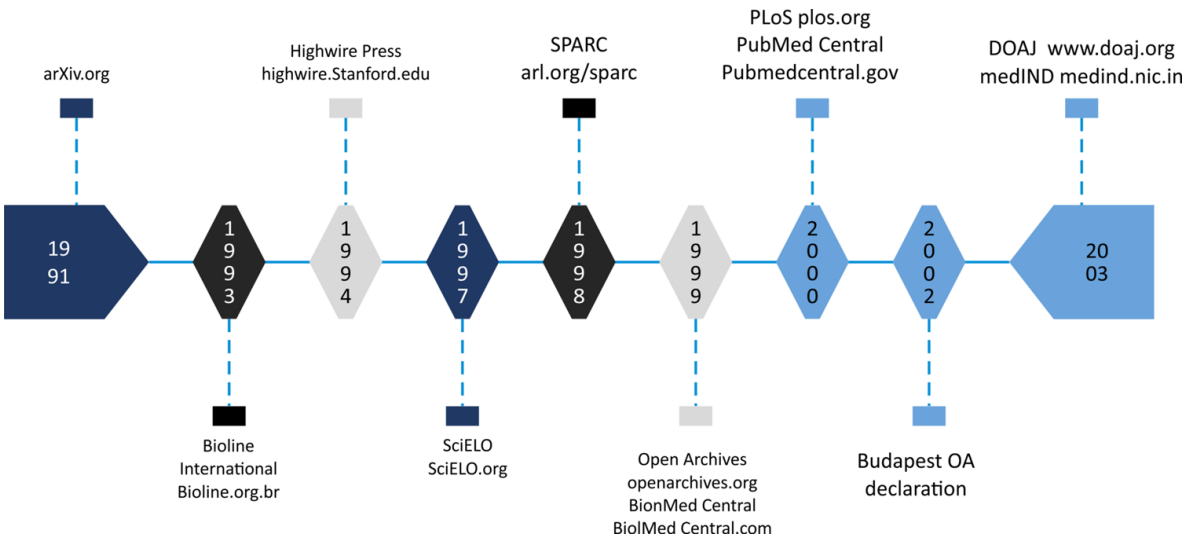
The research within higher education institutions are purely for the benefit of humankind and they are not-for-profit activities. Meanwhile, the commercial side of research focuses on financial profit. This commercial part causes the rich countries can develop science better as they find no difficulties in getting access to scholarly and scientific publications; while the poor cannot afford to get access to the scientific resources. The awareness of this access divide has existed at least in the last few decades and the idea of opening access to scientific resources for anyone resulted in the Open Access Movement.

In practice, Open Access (OA) is believed to begin in the mid-1990s when Arxiv began uploading full-text articles on the Internet, although actually the effort has been done some years earlier. Parang and Sanders (1994) also mentioned that experiments in launching digital publications had actually taken place in the 1980s but were unsuccessful as the technology could not support it. Meanwhile, Papalardo, et al. (2007) emphasize the OA realization made a real progress in the 1990s with "the launch of several databases and free online peer reviewed journals" (2007, p. 1). Figure 1 shows the OA timeline in the early stages.

The success of OA publishing in the 1990s was then followed by the OA declarations. The 3Bs (Budapest, Bethesda, and Berlin) declarations are considered as the biggest international declarations of OA Movement. Other similar declarations have also been held in various countries; while the academic

Figure 1. Timeline of open access initiatives. Adapted from Folder of International Seminar on Open Access for Developing Countries, by BIREME.



and other institutions started to provide online access to their research results especially after the 3B declarations.

The Budapest Open Access Initiative (2002) defines OA as

The free availability of articles on the public Internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as

data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself (para 3).

The Bethesda Declaration of Open Access (2003) emphasizes the definition of OA by proposing two conditions of publications as follows:

1. The author(s) and copyright holder(s) grant(s) to all users a free, irrevocable, worldwide, perpetual right of access to, and a license to copy, use, distribute, transmit and display the work publicly and to make and distribute derivative works, in any digital medium for any responsible purpose, subject to proper attribution of authorship (para 5).
2. *A complete version of the work and all supplemental materials, including a copy of the permission as stated above, in a suitable standard electronic format is deposited immediately upon initial publication in at least one online repository* (para 6).

The Berlin Declaration of Open Access (2003) indeed encourages research findings to be published "according to the principles of open access" (para 10). Budapest Open Access Initiative reconfirmed the definition of OA later in 2012 as:

Free availability on the public Internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself (2012, para 9).

Since 2003 the OA movement has grown steadily with higher education and research institutions began opening access to their repositories. Another new movement emerged in 2020 as UK and European Union also started their OA for the research funded by the governments in Europe and foundations like Wellcome, a charitable foundation in the UK. requires researchers to have their research reports available for public. This is another good initiative from both the UK and EU.

This global movement of OA has helped people to get access to current information sources, especially scientific papers (Civallero & Plaza, 2008). The ease of access enables scholarly and scientific communication grow faster and therefore science and education can develop better for the benefit of all. Research are conducted for the benefit of humankind. In addition, OA publications can eliminate the access divide (Sawant, 2012), because OA can help people to get access to scholarly works (Gul et al., 2008) without any restriction of both copyright and licensing (Suber, 2012, p. 4). In addition, the Budapest Open Access Initiative (2012) considers OA movement as a way to "accelerate research, enrich education, share the learning of the rich with the poor and the poor with the rich" (para 3).

BENEFIT OF OA

Research published in the open OA format is beneficial because it is available for anyone across the globe, at any time, so that they can get information for their research and increase their knowledge; while the authors will be recognized for their hard works. There are also other benefits of OA for both the researchers and users.

1. Greater visibility
   Publishing OA research papers in can increase the researchers' visibility worldwide. Readers will recognize the authors and may use their research papers for further research that in the long run, knowledge will develop further and this means that the researchers contribute to the development of science. In other words, both researchers and their research papers are more visible through OA publishing because they are accessible anywhere and at any time.
2. Developing interdisciplinary science
   The ease of access to OA publications means that researchers from any discipline may be able to read OA publications. This means that a researcher from one discipline can learn research papers written by other researchers on the same subject but from different discipline. When researchers read research papers from different discipline, they will find different perspective and may collaborate and do research on the same subject due to their similar interest. Therefore, OA may result in increasing interdisciplinarity among researchers from various disciplines.
3. Geographically wider collaboration
   With the availability of Internet, OA publishing may have geographically wider readers as long as they can understand the language. Collaboration among scholars across the world is enabled with the OA publications. OA will bring scholars to know one another and they may collaborate to do further research both in the same discipline and inter-discipline.
4. Increasing the impact of research
   Making research papers available for free for just anyone—scholars, researchers, faculty, students, and public in general will help people understand the issues in various subjects that may be useful and important. In other words, when people in general can get research papers, they may learn the from the experts. In addition, when a funding organization find an important and interesting research papers, they may support the researchers to do further research.
5. Usage of research
   Research data put in the OA repository will enable further research conducted by other researchers and there will probably be more findings. Meanwhile research papers published as OA will also help governments and stakeholders to make decision faster. There are benefits of using OA research.

BUSINESS MODEL OF OA PUBLICATIONS

In the beginning of OA publications, there were only articles of journal publications available online and free but now OA comes in various types. Besides OA journals, there are also Open Monographs, Open Conferences, Open Educational Resources, OA repositories, OA Thesis and Dissertations, and Open Data. OA research data repositories is the latest development.

The varied OA business models welcome readers to get knowledge for free. OA publications have been so beneficial and important for students, faculty, researchers, and even decision makers and people in general. Open Monographs provide readers with free books. Readers may download and read OA books that have the same quality as the commercial ones. This model of book publications has a big number of readership and it helps readers who cannot afford to buy books to get knowledge. In relation to OA monographs, there are also Open Educational Resources where readers can also learn any subject of interest and gain knowledge without attending courses in any university. Meanwhile, in order to get

knowledge from current research, readers may go to OA journals available from academic institutions and OA publishers. It is interesting to note that nowadays, commercial publishers also share up to 10 per cent of their journal articles for free, as a result of OA movements. To get the research results in various subjects, readers can also go to OA repositories including OA thesis and dissertations. When readers want to continue research on the same subject of interest, they may get data from OA data repositories.

OA APPROACHES

In providing publications, OA has several approaches. OA does not mean that everything is accessible directly after submission or uploading of materials. There are several approaches of OA.

1. Gold OA means that the publications are accessible right after they are published. This is possible because there is funding for publishing OA materials;
2. Green OA contains various materials including preprints, manuscripts, and other publications that comply with legal framework or copyright. Some institutions also consider thesis and dissertations as green OA and part of their institutional repositories;
3. hybrid OA is available as both OA publications from the institutions and at the same time, it is also accessible from any commercial database vendors. Dissertations from American universities are available in this approach. Readers can access dissertations from the universities for free, but they must pay to get the dissertations from a database vendor;
4. Delayed OA means that for a specific period of time, the publications are not free, for a certain period of time, for example for 3 or 6 months after publication. Readers must purchase the publications during that time, but they can get the publication for free after the embargo;
5. Short-term OA is the opposite of delayed OA and it welcomes readers to enjoy free access to publications for a short period of time just right after they are published. Later the publications will cost some money. However, this approach is not so common because the commercial side will be affected when the publications are already shared on the Internet;
6. Selected OA has existed as an impact of OA movement. The commercial database publishers now offer up to 10 per cent of their publications for free. Selected OA means that in every issue of certain journals, readers can access certain articles freely without any purchase. In addition, readers can get some selected chapters of e-books or even a certain number of e-books for free;
7. partials OA means that certain pages of a publication from commercial database publishers are freely accessible. This is also the result of OA movement.

OA DIRECTORIES

The increasing number of OA publications have brought to the awareness of having directories. The directories enable readers to select OA publications easily. Currently there are Directory of OA Journals or DOAJ (https://doaj.org), Directory of Open Access Books or DOAB (https://www.doabooks.org), Directory of Open Access Repository or OpenDOAR (https://v2.sherpa.ac.uk/opendoar), Directory of OA Repository or ROAR (https://roar.eprint.org/view/type), Open Conferences (Web of Conferences) (https://webofconferences.org), and Open Data Repository (for example https://opendatarepository.

org). These directories are helpful because readers can search for the OA publications they need. It is also important for the profession as the data offer information concerning the development of OA of all types worldwide.

Based on the current data from DOAJ (19 January 2022), there are 17,381 OA journals (doaj.org); while the number of OA books has reached 48,420 titles listed in DOAB (doabooks.org). According to OpenDOAR (2022), the number of repositories is increasing and there are now 4,058 journal articles, 3,364 thesis and dissertations, 2,023 conference and workshop papers, 1,939 reports and working papers, and 4,309 other publications available in the registered repositories (see table 1 below).

Supported by the directories, these OA publications can help researchers and scholars in general to get access to publications for free. The development of OA books, OA journals, OA repositories, and other OA publications do help researchers and scholars from developed, developing, and underdeveloped

Table 1. List of directories of books, journals, and repositories.

No.	Source	Number of titles	Types of publications
1	Directory of Open Access Journals (DOAJ)	17,381	Journals
2	Directory of Open Access Books (DOAB)	48,420	Peer-reviewed books.
3	Directory of Open Access Repositories (OpenDOAR)	15,693	Thesis, dissertations, articles, working papers, workshop and conference papers, and other types of publications.

countries alike.

OA OPPORTUNITIES AND BARRIERS

As stated above, OA has been widely discussed and implemented over the last two decades. OA has been declared in various countries and it has been implemented in higher education institutions, national agencies, research institutions, and also in the governments. It is also interesting to note that both commercial and OA publications are available for readers. Researchers may publish their papers in either commercial or OA publishers depending on their interest.

The OA publications by academic and other institutions have actually impacted on the commercial database publishers and nowadays the commercial database publishers have agreed to share their publications as OA either as selected or partial OA. Some other commercial publishers also have delayed OA models. Regulations concerning their way of sharing publications as OA depend on their decision.

The OA development has opened opportunities for readers to get research papers from other scholars more easily. Scholars may share their research to other scholars, to collaborate with other scholars, and to be recognized. However, while OA has been widely discussed and implemented, stakeholders, decision makers, and other parties involved in the scholarly communication cycle do not always agree with the OA ideas. This has been a concern to make more scientific resources available for scholars and research may impact on the development of science and welfare of the nations. In some countries including In-

donesia, OA publishing still has to struggle especially due to various reasons such as understanding of OA, OA policy, OA quality, and awareness of OA existence.

In Indonesia, OA models that are already implemented include OA journals, OA books, OA repositories, and Open Data. Although OA has existed in Indonesia for over a decade, but those four types of OA still need consideration and further development. As all parties involved in OA implementation in Indonesia are not always in the same view, they need to work together so that the objectives of OA will be reached. At present, they seem to have different views of OA.

OA IN INDONESIA

OA has not been a big issue in Indonesia before 2010. A study by Priyanto (2015) shows that even in 2015, there was still lack of understanding about OA among librarians; therefore, the implementation of OA model is based mainly on the practical side and is only based on the view of librarians and the objectives of individual libraries. Meanwhile, as academic integrity was also not a big issue yet before 2010, it was very probable that students and other academicians might consider copying research papers from Internet, including repositories, would be safe and no one would not find out the academic misconduct.

Before 2010 actually there were only a few academic libraries offered OA for their repositories and few people knew about this. It was in 2010 that a thesis available in a public university library's repository was downloaded and copied to be another thesis in another public university—only the name of the author and the research location were replaced—and then it was forwarded to the committee as a new thesis. After the defense was passed, the thesis was made available in the repository of the university library and some readers found this act of plagiarism. This became a big issue when the act was found out and later the university withdrew the degree. Similar misconduct did exist in some other universities. Even a professor was forced to resign after he published an article in a newspaper but it was found that some parts of his article was an act of plagiarizing a student's paper.

In the Indonesian higher education institutions before 2010, research papers, thesis, and dissertation were submitted to the libraries mostly in the printed form and some used CDs or thumb drive. The online submission of research papers, thesis, and dissertations are conducted only in the last few years, although some universities still require students to submit both printed and digital forms; and few higher education institutions require students to submit only printed ones. However, no data are available regarding the formats of thesis and dissertation in every institution yet.

After being technically processed in the library, the printed or digital formats of research papers, thesis, and dissertations were usually available only for those visiting the libraries physically. A few libraries provided online repositories of research papers, thesis, and dissertations, but users could only read those materials, either fully or partially, and no download facility was available. In addition, there was an academic library that applied a very strict regulation regarding those research papers, thesis, and dissertation, in which a library user was not allowed to take picture of the screen with research materials on it. When a library user was found out taking pictures of the screen, the librarians would check the camera and asked the library users to delete all of the pictures of screen containing the texts of research papers, thesis, and dissertations. No photocopying and printing of research papers, thesis, and dissertations were allowed in many academic libraries. However, some libraries still allowed users to xerox or print those repository materials for a limited number of pages which result in incomplete xeroxed or printed material that the user's need. There was criticism regarding the way librarians man-

age their resources—whether the librarians were the guardians of knowledge or the guardians of access to knowledge. Fortunately, the librarians have changed their way of serving users and welcome users to use the repositories although users should still visit the libraries physically.

Nowadays, there are two models of access to Indonesian repositories—either closed or open. The closed access to repositories made library users come to the libraries physically every time they need research papers. While some libraries already applied OA for their research reports, thesis, and dissertations, many still restrict or close the online access to these resources. Meanwhile those libraries with OA repositories, sometimes do not exactly provide OA fully because the readers can only read some chapters instead of the complete fulltext.

The closure of online access to repositories of research papers, thesis and dissertations has made them to have less readers on the one hand; and on the other, it enables anyone to copy and modify others' thesis and dissertations to become their own thesis and dissertations without anyone being aware about this practice. The restriction of access to repositories actually has made the libraries have less visit either onsite or online, but the librarians consider this as the best way of keeping the academic integrity.

A different case exists in book publishing, where authors still prefer to publish printed books instead of ebooks. This happens because when people buy an ebook, they may share the ebook to their colleague and this will displease the publishers. Publishers still enjoy printing books because they can get better revenue than producing and selling ebooks and they can also avoid illegal sharing of ebooks. However, this has made ebook industries do not run well. In addition, OA books have not been available so far. Authors may either have not been familiar with OA books or consider the cost of OA publishing is not affordable.

Unlike OA repositories and OA books, OA journals are the most in number because journals in Indonesia should be made available as OA journals if they want to get their journals accredited by Ministry of Education (MoE). Although journals in Indonesia were mostly available in the printed form before 2010 and few journals are still available in the printed form nowadays, but they are moving to online and OA due to the requirements by MoE.

Students are required to publish their research for master's and doctorate degrees in the Indonesian or International journals before they can graduate and these OA journals are usually the best choice among students as they just submit it online and they usually can have their papers published quickly.

The problem with OA journals lies in the fact that faculty and researchers are required to publish their research papers in the international journals indexed by *Scopus* or *Web of Science* if they want to get better careers—for example to become professors. They usually publish their research papers in foreign journals because the journals are considered as international, while publishing in the Indonesian journals are considered as local. For those who publish in the journals indexed by *Scopus* or *Web of Science*, they will get better credit for their career. In addition, researchers and faculty still consider publishing in OA journals or Indonesian journals in general is usually not of quality and they will not get credit. This raises a question, when and how Indonesian OA journals can have better articles if researchers and faculty do not submit their research papers to the OA journals available in Indonesia but they prefer to publish overseas.

With regards to OA data or Open Data, the National Innovation and Research Agency (BRIN) has launched a website for data repositories. There is also a new law that requires researchers to submit their research reports including their data to BRIN's research data repository. Researchers have not known this issue as there is no further information and socialization about the law and regulation so far. Researchers usually also keep their data closed and do not share them to others.

Data management is also new to researchers and they are still reluctant to submit their data for public use due to various reasons. These four issues of OA in Indonesia—OA repositories, OA books, OA journals, and OA data—are discussed in this chapter.

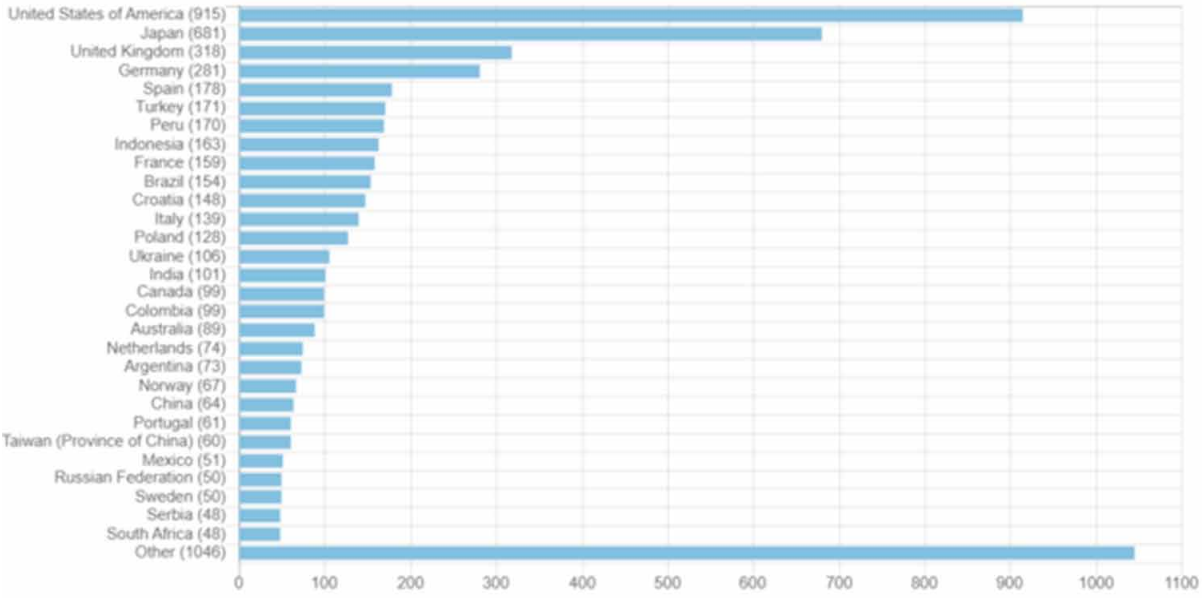
DISCUSSION

An OA publication is considered valid if there are three requirements: "free accessibility, further distribution, and appropriate archiving" (Velterop, 2005). OA is beneficial both for the readers, authors, and science in general. there are several OA models and approaches that an institution may choose to implement OA publishing. Academic and other institutions started to apply these models according to their decision and consideration. The most fundamental OA issue is when publications are freely available online to all readers.

The real OA movement in Indonesia began about a decade or so ago when a few libraries offer research papers, thesis, and dissertations in their websites for free. A few years later, journals began available online for free too. The government's regulation requires journals to be OA journals if they want to get their journals accredited by the MoE. During the last 4 years, issues about national OA data repositories has also emerged. It began with seminars, workshops, and discussions on Open Data, data repositories, and data management. BRIN followed up this with the new law on national research data and reports submission to BRIN for the government-funded research. Unfortunately, the law has not got attention from among researchers as there has been no socialization yet.

It is interesting to note that during the last few years, discussion, workshops, and implementation of OA in Indonesia are widely conducted and faculty, researchers, and librarians are enthusiastic with the OA programs. The chart, in Figure 2 below shows that Indonesia ranks 10 in the world in terms of OA repositories according to OpenDOAR.

Figure 2. OA repositories rank by country according to OpenDOAR.
Retrieved from https://v2.sherpa.ac.uk/view/repository_visualisations/1.html



OA Journals

OA journals have developed so rapidly compare to other OA models. This is understandable because government regulation requires all journals to be OA if they want their journals accredited by MoE. Therefore, most journals in Indonesia are actually OA journals nowadays although they are not always registered in Directory of Open access Journals (DOAJ). According to the Ministry of Education, Culture, research, and technology, currently there are 5990 journals in various fields in Indonesia (https://sinta.kemdikbud.go.id/, 2021). In fact, Indonesia is the second biggest supporter of OA journal publications after England (Irawan et al., 2020). However, out of 5990, there are only 1513 journals or 25.26% registered in DOAJ.

Soon after MoE issued the regulation, journals in Indonesia moved to OA and all journals apply an Open Journal System (OJS). As we all know, OJS is an on-line journal management and publishing platform that was first launched in 2002 as open-source software (Lukman et al., 2012). Most Indonesian journals are managed by universities and some research institutions. The ease of managing journals using OJS makes it easier for anyone to submit their research papers for publications as journal articles. Therefore, students who will attend the graduation prefer to submit their research papers to OA journals. The OA journals also gets benefit from the universities' requirement of master's and doctorate students to publish their research papers in journals after they do the defenses, because they can get publication papers most of the time.

Besides university press management and faculty members, librarians in Indonesia are also involved in the OA journal publications such as being editors, reviewers and managing the OA journals.

By having all journals available in the OA system, there is also no commercial aspect of journal publications in Indonesia and therefore they do not compete with other commercial journal publications.

While OA journals can be an effective way to share scientific information, the regulation by MoE that requires all faculty members to publish their research papers in the foreign commercial international journals discourages the Indonesian journals to grow in quality. OA journals only gets research papers mostly from students, because faculty members submit their research papers to any international journals. Therefore, OA journals in Indonesia do not always have reputable authors.

Language is another barrier for the Indonesian journals to become internationally recognized because most Indonesian journals are available only in Indonesian language. The language of OA journals limits readership. Indonesian OA journals get a small number of readers. In order to get readers worldwide, Indonesian OA journals should also be written in the international language. Wider readership will result in recognition of authors and the journals. In other words, quality of articles and language are still the barriers for OA journals in Indonesia to develop.

OA Repositories

There are national repository system, subject repository, local repository, and institutional repository models. The latter is a medium for acquiring, preserving, and disseminating research and other scientific activities conducted by an institution (Jeelani et al., 2016). Through an institutional repository, readers can get resources from the institution. OA repositories can be very helpful for so many readers. In Indonesia, institutional repositories are growing. Besides research reports funded by the institutions, the repositories contain mostly thesis and dissertations. Before graduation, students should upload their thesis or dissertations to the institutional repositories belonging to the academic libraries and write an article to be published in journals. Earlier, especially in 2000s, the academic libraries required students to submit theses and dissertations both in the digital and printed version due to the fear that the digital version might not always be available as the infrastructures were not robust. As the number of printed versions grew so quickly, the libraries could no longer afford to manage them. Finally, they ask students to submit only the digital version. Unfortunately, the printed-version thesis and dissertations dated before 2000s were also digitized and the printed versions were destroyed, instead of being moved to the Archive Department in the institution.

There are over 4,000 higher education institutions in Indonesia and many of them are developing institutional repositories, but not all are OA. There are Closed-Access repositories, partially Open repositories, and OA repositories. In addition, only 163 institutions have registered their repositories with OpenDOAR so far. One hundred sixty-three OA repositories belong to universities, polytechnics, and academies, organizations or agencies, and a hospital.

Suprisingly, although those institutions have already registered their repositories in OpenDOAR, the readers cannot always get the full text. According to Priyanto (2015) higher education institutions do not always open their repositories because (1) they are afraid that their scholarly works will be copied by users; (2) they are afraid people may find out that some of their scholarly works are the results of an act of plagiarism; and (3) they are not ready with the infrastructure including Internet access. Lack of understanding of OA is likely the main reason of the issue.

OA Books

While Indonesian publishers still focus on printed books, quite a few publishers offer ebooks as they worry that they cannot get revenue due to the ease of readers to share ebooks. Readers are of the opinion that

buying an ebook means they have the right to share with others. Meanwhile authors still prefer publish printed books as they are physically visible and the market is still high. With regard to OA books, it seems that Indonesian authors have not consider them. This is understandable because publishing OA books still need administrative works that cost some money, authors do not always have budget to produce OA books, and publishers still want revenue. Sponsors are needed to publish OA books.

Open Data

Open Data is still emerging. Most academic institutions still do not keep students' and researchers' data. The institutions let students to keep their own data and researchers usually keep their data themselves. They still consider research data are for their own research only and may only be used for the specific and single purpose. Sharing data has not been common in Indonesia. However, as mentioned earlier, discussions, seminars, and workshops on research data management, Open Data, and Data repositories attracted decision makers; although no individual higher education institution have considered to require their students to submit their research data. Instead, they just submit the research results in the forms of thesis and dissertations.

Nationally, BRIN has initiated research data repository since 2015 and it has begun to prepare the infrastructure for the repository since 2017 but the number of data submitted is still low as researchers are not always aware of the importance of research data repository and data sharing. BRIN is open to anyone in any field from any institutional background, such as universities, government, and private research institutions, industry, or ministries, to submit their data so that the data can be reusable. In the beginning, researchers are expected to submit their research data and report if they are funded by the government. However, Unlike European Union's open data regulation in which only government-funded researchers should submit their research data and reports, BRIN welcomes all research data and reports from researchers in Indonesia. BRIN would like to play a role to store, preserve, and share research data from Indonesian researchers so that the data may be reusable. By developing OA research data repository, BRIN will be able to boost the national research agenda and eliminate barriers among researchers who need research data.

Along with the development of BRIN, National Library of Republic of Indonesia has also initiated Open Data for library research in 2019. However, during pandemic of covid-19, the project run slowly. It is important for the decision makers and government to promote the importance of data repository.

Struggles of OA Publishing in Indonesia

With regard to Indonesia, the development of OA publishing is not free from barriers. The challenges are not only from the institutions and libraries themselves, but also from other parties.

Institutional repositories are not always well managed, some become a routine of the libraries to receive thesis and dissertations in the digital format. This is surely due to lack of understanding of OA and how to develop OA repositories. Many academic libraries still keep their repositories closed access for some reasons stated earlier, and to get the full-text resources, one needs to visit the libraries physically. If they are from the same institution, they may come to the library easily, but if they are from other institutions, they need to submit some administrative requirements such as a letter from the institutions, a form containing information about personal information, purpose of visit, etc. OA repositories are not always fully open. Some offer abstracts only, while some open one to three chapters only, and some

other types of restriction. For one thing, they close their access because libraries are of the opinion that OA may cause academic misconduct, especially plagiarism. Meanwhile other libraries consider their repositories have aspects of plagiarism and so they keep their repositories closed in order that no one will find out, as stated earlier. Some academic libraries also provide incomplete or partial text to read in their OA institutional repositories, for example, only chapter 1, chapter 2, and references are available to read, while the research finding, discussion, and conclusion remain inaccessible. The act of guarding access instead of guarding knowledge in the libraries has forced readers to visit the libraries to read the full papers.

Academic librarians in Indonesia are indeed somewhat familiar with OA and OAR. However, they lack understanding of OA and they implement OA repositories based on the technical side. Actually, they also understand the benefits of OA, but limited understanding causes them to know only the technical side and the implementation is mostly based on the goal of achieving a certain rank such as the world-class university rankings and Webometrics (Priyanto, 2015). It is important to include Open Access in the curriculum of Library and Information Science Department so that librarians have better understanding of OA. There should also other programs for librarians to understand OA, for example seminars, discussions, and workshops.

OA journals that have been developing well will surely beneficial in the long run. The policy that researchers and faculty members should submit their research papers to the international or foreign journals indexed by *Scopus* or *Web of Science* is not relevant for the development of OA journals. Indonesian scholars do not always have the opportunity to read the research papers in English due to their lack of English capabilities. In addition, MoE should not only consider the publications by researchers and faculty members in the international journals but also consider how to internationalize the Indonesian journals so that the Indonesian journals are also indexed by *Scopus*, *Web of Science* and other indexers. It is better for MoE to allow researchers and faculty members to publish their research papers in the Indonesian OA journals written in either international language or Indonesian and they are acknowledged equally. This way, the Indonesian OA journals will have better quality and more readers.

Open Data is beneficial for sharing knowledge and research collaboration, increasing research quality, and research efficiency. The initiatives from BRIN and National Library of Indonesia to have OA research data are a good beginning. In order to have a good research data nationally, BRIN must take immediate action by announcing the research data submission regulation to institutions that have research activities. It is also important to do campaign on the importance of research data repository. Apart from those two national institutions, higher education and research institutions should also initiate research data repository in order to support the academic integrity.

FUTURE RESEARCH DIRECTION

OA Research in Indonesia is an example how the understanding of OA is important. Without understanding OA completely, the implementation may not be relevant. Collaboration among several parties to develop OA—OA repositories, OA books, OA journals, and Open Data—will build a strong and robust OA content, management, and services. Until now, few research on OA have been conducted in Indonesia. Further research is needed for better understanding of OA and its implementation.

There has no research on OA book publishing and this will be valuable for all parties—governments, publishers, researchers, and readers—because there are a lot of aspects to analyze, for example funding,

authorship, readership, and management of digital publishing. Without any existence of OA books, the academic and education support in general show lack of digital technology development. It also shows how digital publishing runs slow in Indonesia that the condition may affect the digital literacy and reading in general.

Research publications in international journals may affect on the quality of Indonesian OA journals. Research on the policy of research publications will contribute to the awareness of Indonesian readership. Indonesian scholars need research papers to be published in Indonesia instead of overseas only so that Indonesian scholars can also read them more easily. In addition, to develop wider readership, OA journals in Indonesia should have global readers. Indonesian research will be unknown in the world if they are published only in the language that is known by Indonesian scholars. International collaborative research will follow if research in Indonesia is known globally. Therefore, further research on journal and OA journal management is necessary, especially in order to support the emergence of Indonesian OA journals worldwide.

Institutional repositories will be valuable if the content is fully accessible, therefore, academic librarians should learn further about OA and its management as well as collaborate with the university management, researchers, students, and faculty to formulate a better institutional repository. An OA institutional repository is a medium to collect all research conducted in the institution. Further research on OA institutional repositories will help improve the management of it. It is also important to do research on academic integrity as academic misconduct may still exist in various institutions.

The implementation of Open Data or Open Research Data nationally need to be appreciated. This will contribute to the development of science and research as well as collaboration among scholars. The slow development of Open Data implementation has not been analyzed yet; therefore, research on Open Data is also important.

CONCLUSION

Open Access has been available almost 30 years ago and it has been declared almost 20 years ago in Budapest which was then followed by Bethesda, Berlin, and other OA declarations in various parts of the world. OA is not only in the form of OA journals, but also OA books, Open research Data, Open conferences, OA repositories, and any others. Developing an OA publishing is important and valuable for the benefit of science, scholars, and readers in general. However, it is not always easy to develop OA due to lack of policy; lack of understanding of OA, lack of collaborative works, and slow implementation.

OA journals have developed well in Indonesia but they need attention from the policy makers and the government. It is expected that OA will have wider readership. Lack of understanding of OA and its implementation result in poor accessibility to research and other resources output from any institution. There should be programs to develop the understanding of OA, for example by way of including OA as a coursework in the LIS department. Meanwhile Open Data has existed and need further actions from the institutions; while OA books still need further investigation.

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Chapter 5
Scholarly Communication Practice and Strategies in Institutions of Higher Learning in Africa: An Overview

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ABSTRACT

This chapter explores scholarly communication practices and strategies in institutions of higher learning in Sub-Saharan Africa to increase visibility and reputation. For long, it has been acknowledged that foundations of institutions of higher learning rest upon creating and disseminating knowledge, which serves as an engine for scientific progression leading to a knowledge society. This is true despite scholarly communications receiving limited recognition from senior leadership at most institutions of learning. Visibility of institutions via scholarly communications is of high significance considering the inputs made by scholars and the applicability of study findings for perfecting routinized works or correcting faulty systems in departments, ministries, and agencies in nations. This is evident in developed countries who furnish their scholarly communication offices with librarians to enhance the production and communication of knowledge. Strategies and practices of scholarly communications among institutions of higher learning are discussed.

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INTRODUCTION

Scholarly communication in sub-Saharan Africa will remain latent or in a state where it is, unless ramped up by using technologies and freed from decades-old models of publishing (Malape, 2017). This is true as scholars on African continent account for 1% of the total global research output (World Bank, 2014). To buttress this point, sub-Saharan Africa produced only 11,142 scientific researches in 2008 where South Africa contributed 46.4%, followed by Nigeria (11.4%), and Kenya (6.6%) (UNESCO, 2010, p. 285), which make these countries the top three knowledge producers on the continent. Alternatively, according to Ezema and Onyanchan, (2016), in terms of the global representation of Registry of Open Access Repositories (ROAR), Africa contributed only 136 (3.4%) of the total 4055 repositories. There is discrepancy of repository with respect to 56 countries in Africa. That is, only four countries accounted for 60% of the total repositories in the entire continent. These countries are South Africa, Kenya, and Egypt and Nigeria contributing 47 (34.6%), 14 (10.3%), and 11 (8.1%) respectively. The implication of this low number of repositories implies poor visibility of universities in Africa. In addition, for regional distribution of African contribution to Directory of Open Access Repositories (DOAR), out of 132 repositories, Central Africa contributed 2 (1.52%), East Africa 35 (26.52%), North Africa 27 (20.45%), South Africa 45 (34.09), and West Africa 23 (17.42%). Among the 20 countries present in ROAR and DOAJ, South Africa has more repositories in ROAR and DOAR while Egypt has more than 70% of contributions to DOAJ. Furthermore, in DOAR, multidisciplinary has majority (66%) of the entire entries in the repositories, science has more entries than humanities and social sciences combined (Ezema & Onyanchan, 2016). By implication, positioning of Egypt as the most contributing country (70%) among the 20 participating countries in Africa to the Directory of Open Access Journal (DOAJs) paves way for her to retain an apex in scholarly communication practice (Ezema & Onyanchan, 2016).

Besides, to curtail these inherently invisible statuses of the continent, research output compelled adoption of three approaches, namely; "*OA journals, donor-funded schemes, and negotiated access schemes*" (Malape, 2016, p. 7). Throughout these activities, scholars in institutions of higher learning are the engine behind knowledge production. The major concern of institutions of higher learning, where these scholars mostly operate, is the improvement of their efficiency and effectiveness that maximizes the relevance of the impact of funded research outputs (Neylon et al., 2014a). The effects of these impacts are beyond scholarly community consumption but encompass "*influence on policy, improvement in health and living standards, cultural enrichment or an improved environment*" (Neylon et al., 2014a, p. 1). The assessment and reward of these impacts are in conformity with the missions and visions of those institutions. From altmetrics analysis, mentions in blogs, number of re-tweets or saves of articles used as a measure of scientific publication (Priem, & Hemminger, 2010; Torres-Salinas et al., 2013); it follows that, a scholar's visibility, impact of research, and scholarly contributions can be attested via many platforms (Czerniewicz et al., 2014). In this regard, Open Access (OA) is the only hub to access research outputs optimally and rapidly nowadays (Lwong, 2013). This is a threat to academic libraries, which continue to risk irrelevance in the scholarly information use practice (Schonfeld & Housewright, 2010) since most libraries have failed to employ strong technology, service policies, and marketing strategies. This is against the already established findings that indicated an increased usage of those libraries for supporting researches (Budd, 2009). This raised some questions regarding the central or marginalized role academic libraries can perform in the contemporary practices of scholars (Nyquist, 2010).

Using Google Scholar and OA in the scholarly communication system is taking over the discovery process (Burns, 2014). In the chaining process, Google is the third (70%) intermediary component in the

discovery process; serves as a platform for searching electronic resources including full text databases (90%), etc. (Ellis et al., 1993). To support the above claims, in January 2013 alone, there was an estimated 957,958 OA articles published in 8,537 journals (Directory of Open Access Journals, 2013). Similarly, 17% of the 1.66 million articles published in 2011 and indexed in the comprehensive article-level index (Scopus) are OA (Laakso & Björk, 2012). Furthermore, 67% of 1,184 of the larger scientific publishers formally declared for self-archiving (SHERPA/RoMEO, 2012) are OA. To buttress this point further, as of 12 January 2013, there were about 2,251 institutional repositories globally (Directory of Open Access Journals, 2013). In terms of awareness about OA, there was a drastic decrease from 50% unaware scholars in 1990s to 15% by 2007 (Xia, 2010). This finding concurred with Schroter et al., (2005). Likewise, in sub-Saharan Africa, there is an increase in terms of awareness of OA from less than 60% in 2007 (De Beer, 2006; Lwoga et al., 2006) to more than 60% (Fullard, 2007; Southern African Regional Universities Association, 2008). In fact, some well-established publishers like Elsevier, Springer, and Taylor & Francis began to convert to OA but with a consequential cost on authors who want to publish with them (Narayan et al., 2018).

With regards to some specific issues about OA, such as self-archiving or existence of institutional repositories, Swan and Brown, (2005) indicated that a substantial number of respondents were unaware of self-archiving. In addition, Kim (2010); Mischo and Schlembach, (2011) in USA and Kennan (2007) in Australia separately indicated that scholars were unaware about the existence of institutional repositories in their respective institutions. Similar findings on unawareness about self-archiving were analogous in developing countries like Malaysia (Abrizah, 2012; Singeh et al., 2012) and Cuba (Sánchez-Tarragó & Fernández-Molina, 2010). The fact that, the vigor of research can be misplaced, potential access denied, and usage deprived of, and research impact lost, encouraged many researchers to proclaim that, articles published in OA must receive maximum readability. To support this claim, Davis et al. (2008) showed that, OA journals accounted for 89% more full text downloads compared with subscription journals. OA articles receive 25-250% or higher citation, which increases research impact (Swan, 2010). Besides, the advantage associated with OA articles in all domains is around 300-450% (Swan, 2010) than the corresponding subscription journals. OA articles from Africa are very low in numbers (De Beer, 2006; Dulle et al., 2010; Lwoga et al., 2006; Southern African Regional Universities Association, 2008). The software used to archive information repositories in Africa are mainly D-space, Eprint, and Greenstone. While D-space remains the dominant 97 (73%) software for archiving, 12 (9%) used Eprint to archive their resources and only 4 (3%) used Greenstone for archiving (Ezema & Onyanchan, 2016).

The low OA in Africa is attributable to many factors. Notably among the most prominent reasons are the facts that, publishers and stakeholders lack sensitization about the services and benefits of Open Access Journals (OAJs) as well as unawareness on how to include journals on database (Nwagwu & Makhubela, 2017). Secondly, the financial handicap with regards to limitation in accessing subscription-based journals for resource-constraint authors in developing countries (Bjork et al., 2009), reduction in subscribing to commercial publications due to high prices by academic institutions and libraries (Alemu, 2009) fueled African OA to lag behind. This served as a catalyst for UK government to intervene in Africa's OA with the intention of designing policies that can complement the lack of visibility of Africa's research in the global domain, thereby annealing the flaring gap between Northern publishers and poor countries (Harle & Warne, 2020). Among the major findings of this report is that, stakeholders in low and middle-income countries (LMICs) agreed that OA is significant but its scope, acceptability, and impact, surrounded by uncertainty and confusion, may suffer. There exists both divergence and convergence among LMICs and Northern stakeholders: they unite in ambition but differ markedly on achieving their desired goals,

which necessitates Northern policies to be flexible and LMICs to draft their policies and regulatory tools if a profitable future is required. LMICs journals are a threat to national and regional research systems, which makes Northern journals more fruitful for LMIC researchers but with unaffordable skyrocketed prices (Harle & Warne, 2020). Summing these findings up will reveal a rather complicated scenario between the Northern and LMICs stakeholders with the optimum conditions of one party becoming the opposite of the other. This signals the complexity of the clear-unclear, objective-subjective, research-practice dichotomies between the haves and have-nots that necessitates their augmentation. This shifts concern to LMICs to understand their invisibility in the global scholarly communications to supplement funders with literature that impede the regional progression through the ages. By so doing, it becomes a limelight to policymakers, program implementers, etc. the depth and scope of LMIC's invisibility so that they can lend their hands to support them accordingly.

It is against this background that, this chapter tries to discuss the caption according to the following subheadings

1. Who is a Scholar?
2. Scholarly Communications in sub-Saharan Africa
3. Scholarly Communication in Institutions of Higher Learning
4. Social Media in Scholarly Communication Processes for Societal Development
5. Open Access (OA)
6. Strategies of Scholarly Communication in Higher Institution of Learning
7. Practices of Scholarly Communication in Higher Institution of Learning

WHO IS A SCHOLAR?

The word scholar has a multiplicity of definitions. For instance, a scholar is engaged in intellectual enquiries and serves as a cornerstone for solving societal problems or testing phenomena and rated based on their scholarly contribution (Adakawa et al., 2019) that is beyond mere learning but encompasses understanding principles and laws of a particular discipline. In other words, scholar is the one whose whole inward intellectual and moral being is correspondingly spread-out, well-organized, nurtured, and reinforced by the stimulus and guidance of truth (Gerhart, 1847) and has interdisciplinary mastery of all or some other branches of knowledge. The most closely related word to scholar is the word "scholarship". Scholarship refers to "*the creation, development, and maintenance of the intellectual infrastructure of subjects and disciplines, in forms such as dictionaries, scholarly editions, catalogues, and contributions to major research databases*" (Higher Education Funding Councils, 2001). This guards scholars against intellectual isolationism and ensures publicly available information objects undertaken not in isolation (Halliday, 2001). Thus, scholarship is a social process where researches are validated through review processes and sharing with others (Borgman, 1990).

Perhaps that is why scholarly communication is a process that denotes output to frequentative process where scholarship remains communicated, used, and developed in a scholarly community (Kling & McKim, 1999). Scholarly communication also refers to "*how scholars in any field… use and disseminate information through formal and informal channels*" (Borgman, 1990, pp. 13-14) or a small portion of scholarly output usually published in scholarly articles or in similar formats (Alexander & Goodyear, 2000). While Graham (2000) divided scholarly communication into communication within formal

networks, public dissemination of research through conferences and preprints and formal publication in prestigious journals; Halliday (2001) referred it to encompass journal articles that report empirical research, review or opinion papers, monographs, multi-contributor editions, software, and databases. Alternatively, scholarly communication envisions "*the system through which research and other scholarly writings are created, evaluated for quality, disseminated to the scholarly community, and preserved for future use. The system includes both formal means of communication (such as publication in peer-reviewed journals), and informal channels, such as electronic listservs*" (Association of College and Research Libraries (ACRL), 2017).

Stressing on the informal scholarly communication, it is observed that, blog shapes a new third place for academic discourse (Halavais, 2006). Some scholars questioned the legitimacy and appropriateness of blog usage within scholarly communication. Braxton et al. (2002) contended that, "——*unpublished scholarly outcomes fully meet the definition of scholarship if they appear in a publicly observable form* (p. 141)" noting three parameters in mind that, it must be public, open for critical review and allow for use and exchange among scholars. To augment the legitimacy and impact of a blog, Borgman (2007) reiterated that,

While most of these new genres are too informal to have been considered publications in a print realm, they do contain important discussions, facts, and reports that are part of the scholarly discourse of a field. Furthermore, they can be captured because digital communications leave a trace. (p. 99)

But how long opens up another dimension of debate. Perhaps that is why Rothenberg (1995) admonished that,

… the significance of many digital documents we consider too unimportant to archive become apparent only long after they become unreadable. Unfortunately, many of the traditional methods developed for printed matter are not applicable to electronic files. The content and historical value of thousands of records, databases, and personal documents may be irretrievably lost to future generations if we do not take steps to preserve them now. (p. 42)

To support the above claims, a rather neologisms (bloggership and blogademia) evolved to denote how frequent scholars adopt blogs as channel for scholarly communications with respect to legal scholarship blogs and across domains (Caron, 2006; Saper, 2006; Smith, 2006; Dayal, 2005). (For details on scholarly communication using blog, see Hank, 2011); (For details on scholar and characteristics of a scholar, see Adakawa et al., 2019).

SCHOLARLY COMMUNICATIONS IN SUB-SAHARAN AFRICA

Sub-Saharan Africa unlike developed countries always faces adversarial implications in terms of its development agendas. Scholarly communication is not an exception. Scholarly communication in sub-Saharan Africa suffered setbacks characterized by subordination, rendering it irrelevant thereby regarding the locals as incompetent in understanding their own problems to subjugation in participating in global transformation agendas, to mention but a few. To begin with, the work of Mitcheli et al. (2020) has detailed greatly these hindering issues that make scholarly contribution of the region invisible, un-

felt, and irrelevant in solving societal predicaments and improving the quality of life and sustainability of the environment. That is why African scholars' works used to be under-resourced, undervalued, and under-represented in so doing overlooking considerable impacts they can play in nation-building, transforming sub-Saharan African regions, or even in global applicability especially in issues bordering policy formulation, program implementation, or decision-making processes (Mitcheli et al., 2020). While some scholars have attributed this handicap to colonialism or post-colonialism (Tikly, 2019), still a critical look at the contribution of African scholars is sidelined thereby rendered of little significance if any (Collyer, 2018). This is specifically visible where Global Northern researchers have dominated all nooks and crannies of academia and scholarly publishing in all ramifications including African studies, and preferences are given to those Westerners neglecting indigenous African scholars experiencing the problems (Briggs & Weathers, 2016). This dominance has fueled the emergence and involvement of Global Southern scholars to publish in international journals (Trahar et al., 2019), which resulted in the creation of Research Database Project for education research in Africa (Mitcheli et al., 2020). Prior to this development, most of the publications in sub-Saharan Africa are confined to institutions and are in hard copy, which implies their reduced visibility and circulation (Mitcheli et al., 2020). Even though there is evidence that shows that, "when a problem is local, locals appear best placed to solve it" (McLean & Sen, 2019, p. 133), still that African region experiences such a domination from developed countries. Production and dissemination of high-quality research truncates due to the restriction of human, material, and economic resources, and faculty members of universities are the producers despite constrained by other responsibilities (Fussy, 2018). From these few instances, it is apparently clear that, the scholarly communication of sub-Saharan Africa is hanging, perplexed, and surrounded by smock-screened issues that its freedom from the shackles of irrelevance will have to go a long way for redemption.

For these reasons, several scholars pointed out the problems of invisibility and impact of scholarly communications in Africa. For instance, Trotter et al. (2014) have outlined three main reasons why African research is relatively invisible, namely

- Despite research in the continent increases absolutely, it decreases in relative terms especially considering high research production by Global North rendering African research invisible.
- Most of the African research outputs are in analogue form or restricted only to formal scholar-to-scholar output (like journal, books or book chapters) failing to take into account considering other informal social media outputs as scholarly communications as shall be seen underneath in developed countries.
- African universities have woefully failed to use a strategic approach to embrace technology in enhancing their knowledge productivity thereby preserving it for future purposes. These are the main tenets of minimizing visibility of research in African continent and its impact on global scale.

Unless the notion of visibility is transformed by mere referring it to include accessibility to *digital accessibility*, African research will continue to suffer invisibility and low impact on a global scale (Trotter et al., 2014). Investigations by these scholars indicated that, the technologies required for OA are either obtainable in African institutions of higher learning, available without restrictions on the internet, or low-cost to buy. To support these views, Malapela (2017) noted that, the factors responsible for the deceleration and invisibility of scholarly communications in Africa include—absence of sustainable funding, bandwidth issues (especially its unavailability and subscription), cost of production, and dwelling

more on local journals that have no impact factors or visibility. In addition, there is the issue of parallelism of European problems and local problems where African scholars must write within the themes of European journal to publish their works, neglecting local issues in sub-Saharan Africa, among others.

SCHOLARLY COMMUNICATION IN INSTITUTIONS OF HIGHER LEARNING

Foundations of institutions of higher learning are usually built upon principles that catalyze the concrete structure formation which reflects the missions and visions of those institutions, which include but are not limited to the production and dissemination of knowledge. This is true, despite some institutions of higher learning not treating the publishing function or scholarly communication as an important, mission-centric effort (Brown et al., 2007), still researchers point out that, scholarly communication receives little attention from senior leadership of those institutions. Scholarly communication, a global product of academic environment that entails generating and sharing knowledge is the root of scientific progress leading to knowledge society (Lederberg, 1993) that has been in existence since the distant past even though having different nomenclature (Feather & Sturges, 2003) for ensuring availability of scholarly information through publication and preservation for future use.

While some scholars consider scholarly communication to refer only to the peer-reviewed literature put out after completing research (Rowlands et al., 2004); others regard it to denote all communication among peers (Harnad, 1995). In the interest of full disclosure, scholarly communication has to do with the methods and approaches employed to pass scholarly information from scholar to information users through various intermediaries. In other words, scholarly communication means the study of how scholars in any academic discipline use and share information via formal or informal channels (Borgman, 2000). Unfortunately, only a small portion of scholars is highly productive, visible and publishing in target top-tier journals (Dubini et al., n.d.) in institutions of higher learning. This dormancy is attributable, according to Cohen (2017), to latency of research outputs by faculty members of institutions of higher learning in highly reputable journals, which lies in the incapacity of scholarly communication skills of academic librarians. The triads mainly scholarly contents, OA and subscribed scholarly resources are usually unfairly imbalanced and blamed for upsetting the equation of institutional mission (Chan, 2018) of meeting the scholarly visibility of such institutions globally. This is true considering the shift from traditionally acclimatized practice where libraries pay to read to authors pay to publish via author pay charge (APC) a consequence of disrupting the subscription models and market (Chan, 2018).

For instance, to harmer on the paradigmatic shift, Chan, (2018) referenced Pinfield and Johnson, (2018) who observed that, "globally the proportion of all scholarly journal articles accessible immediately upon publication, which includes gold or full OA, hybrid APC articles, and green OA, accounted for about 25% of global scholarly articles in 2016 compared to 18% in 2014". Similarly, in UK alone, there was an increment of 20% of OA articles in 2014 to 37% in 2016 (RIN, 2017). Furthermore, there is a projection of annual growth rate of 25% from 2014 to 2020 (Research Consulting et al., 2017). Despite that, there was a decline in OA content growth of 10-15%; however, the report released between periods of 2014 to 2017 indicated a rather good appreciation of 16% increase annually (Outsell Report, 2015). For this reason, the tipping point is extended to 2024 (Research Consulting et al., 2017) for a more elaborate calculation of OA. To make this point clearer, the prognosis for 2018 growth predicted at 15-20% over 2017 in excess of $500M in 2018 (Pollock, 2018) was a clear indication for OA rising costs.

Several researches showed that, gaining relevance and momentum by academic libraries is possible if the library budget is enough to cater for these library services. Commenting on the true picture of the drowning library budgets in the hands of few skewed publishing companies; Johnson et al. (2018) noted that, the International Association of Scientific, Technical, and Medical Publishers (STM), a leading professional publisher that accounts for 66% of all journal articles, which encompasses learned societies, university presses, private companies, new starts, and established researchers. Similarly, STM employed 110,000 people globally where 40% are employed in the EU. It has annual revenues of about $3.3 from book market, $10 billion from English-language STM journal, and $25.7 billion from broader STM Publishing journal. About 41% of the STM revenues come from USA, 27% from Europe/Middle East, 26% from Asia/Pacific and 6% from the rest of the world. This agrees with Steele's (2014) stance that, Big Deal subscriptions nowadays siphon the university library budgets, which benefit a small member of multinational publishers. Equally, despite publishing content witnessing a remarkable switch off where the shift from open information commons to an expensive firewalled multinational publishing environment usually referred to "information feudalism" has become a reality (Drahos & Braithwaite, 2002), maintaining scholarly communication infrastructure (SCI) by scholarly communication infrastructure providers (SCIP) present difficulties or even impossibilities (Skinner, 2019) to those bodies.

On the other hand, in order to ensure equilibrium among scholars, institutions of higher learning in developed countries, staff their scholarly communication offices with librarians, legal counsel, information technology, and publishing professionals (Cohen, 2017). In the same way, in those institutions, they recruit at least one scholarly communication librarian who functions in developing and managing an institutional repository and partnering with other stakeholders on campus (Gilman, 2013). This is to show how scholarly communication plays varying roles at different phases of research cycle (Johnson et al., 2018). Every year, in academic settings, academic environments put pressure on scholars to publish too much, too soon, and the choice for speedy dissemination where targeted audience is expected requires fundamental expertise (RIN, 2009) and well-known scholars have preferences for journal outlets, a recognition for generating grants (Harley et al., 2010). The format for disseminating research remains peer-reviewed journals, conference proceedings and scholarly monographs (Housewright et al., 2013; RIN, 2010). This is the case particularly in this era where the future of scholarly knowledge cannot escape the duality of research-driven or publisher-driven complexities and the roles that universities and libraries can play in this scholarly communication framework (Steele, 2014) brought many scholars to question the usefulness and impartiality of the models used.

To be precise, scholarly communication is the responsibility of every academic librarian (Lankes, 2016; Kirchner & Malenfant, 2013) whose tasks are to sensitize faculty staff on "scholarly publishing, open access, institutional repositories, author's rights, copyrights, information literacy, and librarian-faculty relationships" (Cohen, 2017, p. 10). This is attested to by Harley, et al.'s (2010) report that, first-timer researchers need some pre-requisite information that encourage them to publish in the right venues and avoid wasting time in public engagement or developing blogs, website designs, etc. To augment this finding, Housewright et al. (2013) discovered that, only 1/3 of the researchers make their research available via blogging. Conversely, research showed that, active social media users are enthusiastic and expressed positive attitudes towards disseminating their research findings through emails, blogs, social networks, etc. (Nicholas & Rowlands, 2011; Rowlands et al., 2011; Tenopir et al., 2013). For encouraging staff involvement in using social media for disseminating research findings, RIN (2010), Tenopir et al. (2013), and Nicholas and Rowlands (2011) found out that, age has no relations with using social media and that, according to Nicholas and Rowlands (2011), only passion differentiates young from old scholars.

SOCIAL MEDIA IN SCHOLARLY COMMUNICATION PROCESSES FOR SOCIETAL DEVELOPMENT

Digital technologies have changed the nature of scholarly communication, provided platforms mainly Twitter, LinkedIn, Academia.edu, Facebook, ResearchGate, YouTube, blogs, etc. to support OA (Narayan et al., 2018), transmuted the identity of scholars by enabling networked scholarship (Veletsianos, 2016; Greenhow & Gleason, 2014). These digital platforms connect, and promote research outputs; build networks, and ensure a scholarly culture of openness (Gruzd & Goertzen, 2013) or creating techno-cultural scholarly system (Al-Aufi & Fulton, 2015) different from traditional convention; increase opportunities for scholarly communication (Nentwich & König, 2014); to the extent lack of these platforms hinder scholars from participating in informal communications (Al-Aufi & Fulton, 2015). For long, scientific information that involves a scientist acquiring knowledge to carryout research, knowledge gained or produced, and communicated in the context of research (Romary, 2012) remains an important component for developmental purposes. This makes scientific development possible, economic progress conceivable, and social improvement promising, which depend largely on information transfer (Ying, n.d) prospectively throughout the ages. That is why dissemination of information is an important ingredient in modern society (Garvey, 1979) for solving societal problems or testing phenomena (Adakawa et al., 2019). Research pointed out that, readability of scholarly work depends largely on usage, citation, among others. Perhaps that is why many scholars concurred that, to ensure acceptability of scholarly content of web-based information; quality of information, authority, and topical interest are important (Rieh, 2002). In addition, scholars still use traditional criteria (i.e. presence in the citation indexes, reputation of the publishing venue, open access journal, or archives) for assessing the quality of such scholarly contents (Ponte & Simon, 2011).

Besides, research showed that, usage depends solely on those articles produced by a top-tier authors, published in a peer-reviewed journals attracting no cost for the reader; or alternatively, those articles written by a top-tier authors, in a peer-reviewed not in the top tier journal but electronically available at no cost to end users (Tenopir et al., 2010; 2011). It is important to note that; peer-review is a measure of ensuring quality and reliability of research findings (Mulligan & Mabe, 2011; Rowlands et al., 2004). It functions in filtering academic quality (Harley et al., 2010); selecting the outstanding manuscripts for journal publications, advancing readability of the published works, and detecting errors (Ponte & Simon, 2011). However, this finding contradicted the value of un-refereed social media information (RIN, 2009; Procter et al., 2010; RIN, 2010; Schonfeld & Housewright, 2010) which usually do not replace traditional scholarly information but merely supplement it (Nicholas and Rowlands, 2011; Procter et al., 2010; RIN, 2010; Rowlands et al., 2011; Tenopir et al., 2012). To buttress this point, while RIN's (2010) study indicated untrustworthiness of social media information to many researchers, however, Nicholas and Rowlands, (2011) and Rowlands', et al., (2011) research proved the opposite. Social media reshapes and simplifies scholarly communication especially with respect to sharing and dissemination of research (Veletsianos, 2016; Greenhow, & Gleason, 2014) despite researchers showed inconsistencies with the use of such tools (Manca & Ranieri, 2017; Veletsianos, 2016) in communicating their research. Against this finding, it is conspicuously true that many scholars use social media platforms to promote their research outputs (Donelan, 2016; Manca, & Ranieri, 2017). In addition, it is the academic librarians' roles to inform scholars about the development and trends in scholarly communication (Rodriguez, 2014).

From the citation behavior of researchers, scholars differ on citing other researchers' works, which depend on the perceived authority of the cited work, its author or dissemination channel (RIN, 2009;

Van Dalen, 2005). In other words, it is the author's professional status rather than the methodology used or the demographic features of the author (Lindgren, 2011) that is important especially in performance measurement studies. Likewise, citation is contingent with the quality of information, visibility of the author and not dependent upon the title length or clarity of the theoretical explanation (Stremersch et al., 2007) or personal knowledge of the author (RIN, 2009) except if the author knows something that is worth knowing (White et al., 2004). Many factors attract authors to publish in journals, which encompass refereeing quality or speed, perceived reputation, and impact factor (Mulligan & Mabe, 2011) of the journals. Access to a high targeted audience and readership (Rowlands et al., 2004); or a journal's closeness to faculty members, impact factor and its circulation within the scholarly community (Housewright et al., 2013) are also found to attract scholars to publish in specific journals. It has become commonplace nowadays that; researchers do consider quality of the research more than the quantity of publications (Harley et al., 2010) even if that means to publish less (Mabe & Mulligan, 2011).

OPEN ACCESS (OA)

OA has been in existence since 1990s especially when Harnard (1999) made a proposal on using preprint and post-print articles that caused an intense reaction in scholarly community. This, according to Harnad (1999) would result in publishers stopping charging subscription fees. This brought about open access.

WHY DOES OPEN ACCESS MATTER?

Domain specific research has a critical role to play in disseminating its research to maximize access, show the relevance of scholarly communication that can ensure minimal disparity in scholarly research outputs in such domains globally. Issues on OA are important to study as they assist in the proliferation of publications and the continuity of scholarly communication cycle. For instance, in Tanzania, among the 415 faculty members surveyed, Lwoga (2013) observed that, there was high level of engagement in scholarly publishing, where senior staff were more likely to participate in the scholarly communication as authors, referees, and editors. The research further revealed that the respondents were aware about OA but with a scanty literature of faculty members' research resources in OA. Similarly, the research showed that, the senior faculty members possess more expertise, technical know-how than their counterpart fellow junior staff and the research recommended *inter alia* the responsibility of librarians on creating awareness about OA, conducting information literacy programs, and providing information services on copyright management issues, etc. These issues have a corresponding implication for policy formulation, implementation on OA.

It thus follows from the above that, libraries laden with the responsibility of meeting the needs of users as described by Ranganathan, have been constrained by the skyrocketed prices of journals to make them readily available to end users. Therefore, users can have access to scholarly contents anywhere anytime. To start with, the OA movement has paved the way for libraries to have freedom and compelled the publishing sector to negotiate their pricing and other practices (Bailey, 2005). Furthermore, Suber, (2003) opined that, "open-access literature is characterized by two essential properties. First, it is free of charge to everyone. Second, the copyright holder has consented in advance to unrestricted reading, downloading, copying, sharing, storing, printing, searching, linking, and crawling. The first property

solves the pricing crisis. The second property solves the permission crisis". OA has to do with "an ongoing publication practice which differs from the traditional methods of publishing papers, particularly in context of how the papers get submitted, reviewed, authenticated and finally published (PLoS, 2005). In other words, OA deals with "digital, online, free of charge, and free of most copyright, and licensing restrictions" (Suber, 2004); or more appropriately as captured by Harnad, (2005) that, OA is the "immediate, permanent, free online access to the full text of all refereed research journal articles". Open access, according to BOA and PLoS, is "the free availability of literature on the public Internet, permitting any user to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose without financial, legal, or technical barriers other than those inseparable from gaining access to the Internet itself" (Budapest Open Access Initiative, 2002; Public Library of Science, 2005). Similarly, following the promulgation of The Bethesda Statement on Open Access Publishing (2003), and the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities (2003), the report reads thus that, "the author(s) and copyright holder(s) grant(s) to all users a free, irrevocable, worldwide, perpetual right of access to, and a license to copy, use, distribute, transmit and display the work publicly and to make and distribute derivative works, in any digital medium for any responsible purpose, subject to proper attribution of authorship, as well as the right to make small number of printed copies for their personal use".

The fact that publishers are strangulated in terms of funding and archiving gave rise to several questions and models. Models like authors pay charges (APC), a grant budget, assists in publishing research results (Mukherjee, 2009). In this regard, authors can pay up to $525 to $1500 to publish in PLoS and BioMed journals (Regazzi, 2004). Two strategies were identified in OA: self-archiving and open access journal, the green and gold strategies. For green publisher, they mandate the authors to self-archive their scholarly published work in an open repository. A gold journal or publisher permits the author to self-archive and archives all articles on their website for public consumption (Willinsky, 2003). Purely OA journals do not charge authors any fee rather derive their funding from the institution for staff and infrastructure (Mukherjee, 2009). Less than 20% of journals in the Directory of Open Access Journal (DOAJ) are APC; 28% are the online versions of the print journal whereas governments specifically institutions, and societies sponsor the remaining journals (Regazzi, 2004). There are varieties of other OA that have different colors against the above-mentioned ones. To sum it all, Mukherjee, (2009) referenced ACRL (2004) which uses the following codes for identification.

1. Open Access Journals (OA Journals, color code: green): These journals provide free access to all articles and utilize a form of licensing that puts minimal restrictions on the use of articles, such as the Creative Commons Attribution License.
2. Free Access Journals (FA Journals, color code: cyan): These journals provide free access to all articles and utilize a variety of copyright statements (e.g., the journal copyright statement may grant liberal educational copying provisions), but they do not use a Creative Commons Attribution License or similar license.
3. Embargoed Access Journals (EA Journals, color code: yellow): These journals provide free access to all articles after a specified embargo period and typically utilize conventional copyright statements.
4. Partial Access Journals (PA journals, color code: orange): These journals provide free access to selected articles and typically utilize conventional copyright statements.

STRATEGIES OF SCHOLARLY COMMUNICATION IN HIGHER INSTITUTION OF LEARNING

Knowledge creation is a process that entails "quite rigidly codified pattern" (Dubini et al., n.d., p. 119) that is tedious to adapt, and beyond that, challenges, and causes scholars to limp back and front as if doing nothing with regards to research but works for as a podium for gratification and solving societal problems. It subjects scholarly knowledge to rigor and into a "systematic, premeditated, reflective, and continuously submitted to the scrutiny of a community of experts" (Dubini et al., n.d., p. 119) for inputs from these universally recognized scholars usually in accordance with standardized practice in their respective disciplines for guiding the novices and continuity of scholarly knowledge in a logarithmic phase. The enthusiasm and passion to contribute to scientific growth and development is the ultimate motivating factor for scholars to publish their works (Dasgupta & David, 1994; Merton, 1973) in recognized journals or aids as a badge of sort and scaffolding for promotion and recognition in their institutions (Adakawa et al., 2019; Coe & Weinstock, 1969; MacMillan & Stern, 1987; Gordon & Purvis, 1991).

Thus, from this purview, it appears that the process of creation of knowledge is long, energy-, time-, and steps-consuming prior to conveying knowledge delivery to readers (Cope & Kalantzis, 2000). In a similar manner, scholars do publish their works for economic and social professional progression and as visibility, reputation and personal achievement of scholars increases so does the ability to publish in prestigious journals that give them insights into developing other publication patterns for younger researchers (Dubini et al., n.d., p. 119) to adopt and prosper. Creation of knowledge marks the first stage in the scholarly process (Cope & Kalantzis, 2009) which depends upon the design, a backbone to represent the social process of knowledge. This immediately follows with the integration of concepts whose choice depends upon *inter alia* the domain of interest and inclination (Dubini et al., n.d.).

The essence of communication is to bring about a change (Stanikzai, 2017). The spectrum and wavelength of scholarly communication is broader as it encompasses the growth of scholarly information, associations among grey areas or disciplines, information needs and use of user groups and relationship between formal or informal methods of communication, etc. (Mukherjee, 2009). With the Computer Mediated Communication (CMC), communication changes form from print journals to computer networks (Peek & Pomerantz, 1998) a consequence of affecting the means, strategies, and practices of scholarly communication. Perhaps that is why ACRL (2019) dwells more on the open and equitable scholarly communication with the hope to bring about change. For example, from ACRL's (2019) report, more priority is given to three components: people, content, and systems. The report further suggested that, for people, there is the need for change in embracing diversity and inclusion; improving the working lives of those engaged in SC and increasing awareness on author's rights. While for content, transformation in rethinking what counts, and creating more representative and open collections is highly needed; and for systems, the change should reflect supporting technological infrastructure that are sustainable; creating systems that permit more access to more people, building mission-aligned organizational and financial systems, and advancing innovations in academic libraries.

NEED FOR STRATEGIC PLAN IN SCHOLARLY COMMUNICATION

For the past three hundred and fifty years, only two scholarly journals existed: Journal des Scavans (first issue published in 5 January 1665 in Paris) and in the next two months, Philosophical Transactions of

Royal Society (first published 6 March 1665 in England) (Fjallbrant, 1997) appeared. During that time, the proceedings of the meetings as well as the review of scientific investigations or facts were the main scholarly contain in these journals and were in print format. This trend continued for about 200 years up to the beginning of the 20th century where the journals astounded the libraries. In this respect, a major portion of the library budgets found their way to purchasing these journals (Mukherjee, 2009) a consequence for maximizing the production to meet the demands of those libraries by publishers. Following the speed of change (Senders, 1977), these journals transformed into web-based formats using different e-journal models; for example, ASCII text-based journal (McKnight, 1993). These e-journals are mainly the serials publications available in digital format (Harrassowitz, n.d.) usually distributed through CD-ROM, WWW, e-mail. Some are in ASCII texts, HTML WWW Pages, etc. In other words, two eras were identified in the literature as regards development of e-journal: ASCII (Peek & Pomerantz, 1998) [where the dominant journals were in form of newsletters, non-refereed e-journal, refereed e-journal, and tailored or structured e-journal]; and graphics-enabled e-journals (Kling & McKim, 1997) which can be e-; e-p; p-e; p+e journals.

The fact that performing traditional roles in a new environment is multitasking and challenging has changed libraries as publishers, recruiters of legal practitioners into the milieu of librarianship to function in copyrights laws, scholarly communications and other related legal issues testifies the readiness of these knowledge hubs for the future. The future of scholarly communication should be employing both formal and informal tools in interpersonal, institutional, responsive, and more focused on communication aspects. To differentiate between formal and informal scholarly communication, strategic planning is necessary in this regard. Since libraries select, organize, and disseminate information, they function in collaborating with the scholarly community in universities and around the world; libraries are and should act in this digital environment for the production of electronic resources to audience. To begin with, as Brown et al. (2007, p. 3) argued that, scholarly communication "can enable universities to more fully realize the potential global impact of their academic programs, enhance the reputations of their specific institutions, maintain a strong voice in determining what constitutes important scholarship and which scholars deserve recognition, and in some cases reduce costs". This is only possible if the scholarly community designs strong strategies that can function in this respect. Despite university presses lacking critical resources, capabilities, and technical know-how but possessing unique skills and assets, universities should not underrate or abandon the dexterity or expertise of publishing, as it is very difficult to reestablish. In this perspective, Brown et al. (2007) have proposed several strategies, which include:

- Each university that produces research should have a publishing strategy that employs predominantly e-dissemination channels.
- Consolidation of certain activities and assets in the digital environment into larger platforms.
- Presses should change as the environment evolves that enables creating, storing, distributing, and monetizing e-contents. In this way, emphasis should be on new workflows that create e-editions, digitization, storage, and re-versioning of services using Bibliovault, codeMantra, etc. for the development and maintenance of e-content.
- Furthermore, experimentation with large commercial e-book aggregators such as Amazon, Google, ebrary, etc. is important.
- Finally, there is the need for symbiotic relationships (Neal, 2001) or collaboration between presses and libraries that can create added values. This is because, "Press/library collaborations must be

interactive, nimble, pushing the window on new forms of scholarship—creating new knowledge using technologies and reinventing business models" (p. 26).

- Why don't faculty members want to make their research out into repositories? According to Lwong, (2013), this challenge has nothing to do with the technical challenge rather the cultural change necessitating faculty members to adopt scholarly communication. In other words, policy mandates scholars to self-archive their drafts of researches in a freely accessible institutional repository. Research showed increase of contents after a policy mandate (Xia et al., 2012). However, mandatory policies without creating awareness will be in vain ultimately (Lwong, 2013).

On the other hand, Trotter et al. (2014, p. 8) observed that, for management of universities, the following should be the strategic plan for maximizing visibility and impact of research.

- Offer a reduction in teaching time to scholars who demonstrate ambitious research activity.
- Establish digital platforms for sharing publication success by university scholars.
- Develop policies mandating that all publicly funded research be made open access.
- Put all university-affiliated journals online and make them open access.
- Induce academic staff to create personal profiles on their departmental web pages.
- Establish or identify support service providers who can translate scholars' research for government- and community-based audiences.
- Develop a network of communication officers/content managers so that disparate dissemination activity can be pursued in a more cohesive and strategic manner.
- Encourage scholars to share their research insights on Wikipedia.
- Invest in training for library staff so that they can operate effectively in the new scholarly communication landscape.
- Train and incentivize scholars to use Web 2.0 platforms

PRACTICES OF SCHOLARLY COMMUNICATION IN HIGHER INSTITUTION OF LEARNING

In a contemporary political setting that places more emphasis on transparency, accountability (Lao et al., 2009) and obviously noticeable return-from-investment (Kruss, 2012; Huisman & Currie, 2004); institutions of higher learning are under greater pressure to provide an evidence-based account of the services they render to communities (Neylon et al., 2014b). Despite traditional teaching service has been forthright to measure via national/international accreditations; performance of postgraduate qualifications; etc., scholarly impact of institutions of higher learning, is a significant component of institutional evaluation, puts these institutions on a competitive edge, and the desire to be relevant, persuasive so as to provide desirable scholarly services (Neylon et al., 2014b). Perhaps this is the reason why Neylon et al. (2014b, p. 1) raised a striking metaphor, "whether institutions in sub-Saharan Africa are in a position to meet demands for the improved measurement and dissemination of research outputs". Similarly, the fact that we are living "in a zero-proximity world [where] traditional space-time boundaries have collapsed in a globalized world, and this has garnered an unwavering expectation that any signal to make contact will be returned without delay" (van Schalkwyk, 2014). This implies that, institutions of higher learning are challenged to keep abreast with emerging technologies that can enhance scholarly practices.

There is growing evidence that scholarly communication is changing shape as a result of transformations in research activity itself in higher education system worldwide (Etzkowitz, 2004) and emerging technologies (Tenopir 2003; Palmer, 2005; Thorin, 2006; Procter et al., 2010; Weller, 2011). These make research topography an open space (Van der Vaart et al., 2013) against the traditional one. In other words, libraries and scholarly communication are changing rapidly in a similar proportion (Pendleton-Jullian, 2013) due to the demands of this new age. The choice to pay more considerable emphasis on practice in scholarly communication practice is because of "practice return" in social sciences (Czerniewicz et al., 2014). According to Palmer and Cragin, (2008, p. 169), practice refers to "arrays of human activity" that are "materially mediated" and "organized around shared practical understanding". This pays a particular importance to activities rather than texts and goes opposite to many models of scholarly practice UNISIST (1971), the Garvey-Griffith (1972), Hurd (2000) and Sondergaard, Andersen and Hjorland (2003) models, as cited by Czerniewicz et al., (2014). These models are process-based ones that show where texts go and which group of people take responsibility for processing them (Czerniewicz et al., 2014). Against these models, Procter et al. (2010) and Kraker and Lindstaedt (2011), and Czerniewicz et al. (2014) developed another model that does not concern itself with text and its movement rather the activities undertaken by scholars and their choices in these activities across scholarly culture of each domain specific environment. The fact that, scholars find and disseminate research (Bulger et al., 2011; RIN (2009); they are consumers and producers (Palmer, 2005), scholarly practice is very important for exploration. From the research cycle, that involves knowledge creation and dissemination cycle, there are certain features that define it (Czerniewicz, 2013), there are basic elements, which include conceptualization, data collection and analysis, articulation of findings and, translation and engagement. (For detailed description on practice of scholarly communication, see Czerniewicz, et al., 2014).

The movement for OA paved the way for the institutional repository, a digital archive of intellectual products (Johnson, 2002) which, to some is at the dead end. Institutional repositories, usually developed and managed by academic librarians, offer the opportunity to outreach and promote the contents to the scholars in a respective institutions (Narayan et al., 2018). To some scholars, institutional repositories did not escape their misconception about it because they perceive green OA as a substitute that provides alternatives especially with regards to personal repositories, disciplinary repositories, social network and innovative combination of three (Van de Velde, 2016). Conversely, some scholars in HASS (i.e. humanities, arts, and social sciences) have expressed slow adoption of OA (Suber, 2017) and negative attitudes towards OA (Rodriguez, 2014). This implies that, scholarly communication practice across disciplines is different.

CONCLUSION

Mission and vision of institutions of higher learning must include production and dissemination of knowledge either through formal or informal channels. This is important for their visibility and reputations in the 21st century. Institutions do so by funding research undertaken mostly by scholars that maximize the relationality of the findings to impact on policy, enhanced healthcare services, and delivery, augmenting culture, and better-quality environments. Library budget has relevance if it is enough to cater for all services rendered by those libraries, and scholarly communication offices have to include librarians to perform excellently on the overall development. Institutions of higher learning have to rise up to the challenge and archive their information resources in ROAR, DOAR, and DOAJs for increased visibility.

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Section 2
Embracing Open Access

Open access plays a significant role in accelerating scientific research. This was demonstrated particularly when researchers across the world were racing with time to combat the COVID-19 pandemic. The chapters in this section serve as an overarching framework through which the rationale or the need for open access can be argued, including issues and potential impacts, ranging from reducing misinformation or the spread of fake news on social networks to enhancing data quality, promoting research reproducibility, equity, and inclusion.

Chapter 6
Open Access and Research Reproducibility in Biomedical Sciences

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ABSTRACT

Reproducibility-enhancing practices of open access journals in biomedical sciences are investigated. Based on transparency and openness promotion guidelines and relevant reporting requirements by institutions that are in the forefront of advancing reproducibility research, eight standards were used to evaluate 27 biomedical journals to 1) determine the extent to which these journals address reproducibility, 2) identify specific policy themes required, and 3) understand overall infrastructure promoted by the journals to deposit, archive, share, and discover research assets. The results show that almost all the 27 journals required authors to address six of the eight standards when preparing and submitting their research. Two standards that were not frequently addressed are preregistration of the study and preregistration of analysis plans. 'Data availability' policy is the most recurring theme across all journals. The infrastructure promoted to manage the overall scholarly communication workflow range from data, code, software repositories, protocol registration, to funding registry.

INTRODUCTION

Open Access (OA) is becoming an established method of scholarly communication. After 20 years of application and experimentation - social, technical, political, and economic factors have converged to make OA a viable form of knowledge production and dissemination. While there were attempts to archive preprints in the early 1980s in ftp servers such as the arXiv project, it's by the turn of the 21st century that open access movement gained momentum after the publishing of manifestos and initiatives such as the Budapest Open Access Initiative (BOAI) (Harnad, et al., 2004), Bethesda Statement on Open Ac-

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cess Publishing (Brown, et al., 2003), and the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities (Redalyc, 2003).

Open Access (OA) is defined as "access to literature that is digital, Online, free of charge, and free of most copyright and licensing restrictions," (Suber, 2010). This definition places emphasis on full open access and hides so much details as to what, when, and how the scholarly literature is to be made available in the open. Open access publishing is achieved, with some slight variations, in two ways: gold open access and green open access (Gargouri, 2012; Harnad, et al., 2004). In Gold OA model (mainly in OA Journals), published works are made freely accessible to readers after the cost of the article processing is borne by the author, or by a sponsoring agency, and in Green OA, while there are different variations, publishers allow authors to self-archive their work (Harnad, et al., 2008).

On the other hand, research reproducibility, or the idea of making one's research reproducible garners different definitions and accounts across the scientific enterprise. Often different terms such as - reproducibility, replicability, repeatability, reliability, robustness, and generalizability – are used and create confusion (Goodman et al., 2016). While remaining within the umbrella of 'reproducible research,' extensive coverage is given in the extant literature to the kinds of reproducibility investigated such as – methods reproducibility, results reproducibility, and inferential reproducibility (Goodman et al., 2016) and computational reproducibility (e.g., Grüning et al, 2018). In this chapter, research reproducibility is broadly looked at that adheres to reporting guidelines on data, methods, statistical analytical steps, computational analysis and software codes, and overall research design.

Most importantly the focus of this chapter is to investigate the degree to which open access scholarly journals promote transparency and reproducibility-enhancing practices. The fact that open access journals are shared freely and in the open on the Internet, it is easy to verify the steps taken by the original study so other independent researchers can achieve similar findings, of course within the confines of the new research parameters. The question, however, is which of the bio-medical sciences open access journals require that authors submit manuscripts alongside data, software codes, and sufficient documentation of the overall research design to promote reproducibility-enhancing practices.

BACKGROUND

Overall, there is an increasing recognition of the fact that sharing published works in the open Internet is vital for scientific progress. In addition to the established scholarly journals that follow either the Green or Gold model, the OA distribution ecosystem is fast expanding that covers - for example personal websites (e.g., https://terrytao.wordpress.com/) to OA Institutional Repositories (e.g., https://deepblue.lib.umich.edu/documents) to aggregators, discovery and social reference management systems such as Mendeley (Thelwall, 2018), to OA Directory of Journals (DOAJ) (Morrison, 2017), to research work flow management systems (e.g., https://galaxyproject.org/ & https://wholetale.org/) to repositories of preprints and postprints (e.g., arXiv, bioRxiv, medRxiv, PsyArXiv), to fully OA academic & scholarly publishers (e.g, https://plos.org/), and to OA software - Essential Open Source Software for Science (EOSS) (e.g., https://chanzuckerberg.com/eoss/).

According to ULRICH'S database (Ulrichsweb), the most comprehensive database of periodicals with international coverage (English and non-English), there are about 89,000 active academic and scholarly journals that are referred and/or peer-reviewed - as shown by the search result using the following syntax:

(89,039 results for: Status:("Active") Serial Type:("Journal") Content Type:("Academic / Scholarly") Key Feature:(+"Refereed / Peer-reviewed").

Further refining this search syntax to retrieve OA scholarly and academic journals, about 22,000 results are returned as shown by the following search syntax:

(22,443 results for: Status:("Active") Serial Type:("Journal") Content Type:("Academic / Scholarly") Key Feature:(+"Refereed / Peer-reviewed" +"Open Access").

Without going into a detailed analysis of the tens of thousands of OA scholarly journals returned by the search results above, it is safe to state that about a quarter (24.7%) of the global peer-reviewed journals are now available under some version of open access model - a sign that OA academic and scholarly journals have entered a critical mass.

On the other hand, in the larger context of open science movement, reproducibility has gained momentum to promote openness and transparency in research findings by sharing research and associated assets in publicly accessible outlets. An even more important impetus for reproducibility gaining momentum is because significant proportion of research dollar has gone wasted - as for example in the rate of failure of clinical trials (e.g., Bøtker, et al., 2018), safety issues with approved drugs (e.g., Kannt & Wieland, 2016), or in general reproducibility crisis in published research (Bolli, 2017; França & Monserrat, 2018).

Reproducibility is about rigor, transparency, openness, validation, corroboration, and integrity of published studies. According to the U.S. National Science Foundation (NSF) subcommittee on replicability in science, "reproducibility refers to the ability of a researcher to duplicate the results of a prior study using the same materials as were used by the original investigator (National Academies of Sciences, Engineering, and Medicine, 2019). In other words, a second researcher might use the same raw data to build the same analysis files and implement the same statistical analysis to yield the same results, hence reproducibility is a minimum necessary condition for a finding to be believable and informative (National Academies of Sciences, Engineering, and Medicine, 2019).

While it is easier to recognize the power of reproducibility in the ethical conduct of research, it is often difficult to achieve it in the overall scholarly communication domain. An empirical review of existing literature reveals that there is a consensus about the prevalence of 'reproducibility crisis,' in scientific research (e.g., "Announcement", 2017). According to a survey of 1,576 scientists by Nature 52% agree that there is a significant crisis, and 38% agree to the presence of a slight crisis in reproducibility research, bringing the total to close to 90% (Baker, 2016). The same survey showed that based on 185 research participants from Nature Research, they indicated the major issues for irreproducibility as: selective reporting, pressure to publish, low statistical power or poor analysis, not replicated enough in original lab, insufficient oversight/mentoring, methods, code unavailable, poor experimental design, raw data not available from original lab, fraud, and insufficient peer review (Baker, 2016).

Existing Standards and Guidelines for Enhancing Reproducibility

In biological, medical, and scientific communities, there are several initiatives to develop standards and guidelines to enhance reproducibility in scholarly communications. This chapter reviewed the most important ones to offer context regarding the study at hand.

The National Academies of Sciences, Engineering, Medicine, has published a Consensus Study Report titled "Reproducibility and Replicability in Science" (National Academies of Sciences, Engineering, and Medicine, 2019), in which it included numerous examples of reports designed to improve research practices with a goal of improving reproducibility and replicability. One of the reports by the Federation of American Societies for Experimental Biology (FASEB, 2016), recommend principles and best practices of openness, reproducibility, and rigor in data and science.

Another effort in the biological and medical sciences comes from BioMed Central – a Springer Nature affiliate that publishes about 300 peer-reviewed journals in science, technology, and medicine – developed what it called 'BioMed Central Minimum Standards of Reporting Checklist,' (Kenall et al, 2015). The checklist addresses three areas, i.e., experimental design and statistics, resources, and availability of data and materials.

A similar and most robust guideline is published by the Center for Open Science that is known as Transparency and Openness Promotion (TOP) Guidelines (Center for Open Science, 2021). TOP Guidelines covers eight transparency and openness standards: Citation; Data transparency; Analytic methods (code) transparency; Research materials transparency; Design and analysis transparency; Preregistration of studies; Preregistration of analysis plans; and Replication.

THESIS STATEMENT

As noted, open access (OA) scholarly and academic journals are gaining wider acceptance as one model of research outlets in the larger scheme of scholarly communication. Equally, there is a growing call in the scientific enterprise for transparent and ethical research practices that promote. In view of that, this chapter seeks to investigate the degree to which scientific OA journals in biological and medical sciences promote and advance reproducibility-enhancing practices. What are some of the requirements placed by OA Journals to support reproducibility practices?
Most importantly, this chapter seeks to investigate the following research questions:

1. To what extent open access scholarly journals in Biomedical Sciences promote reproducibility-enhancing research standards?
2. What are the standards in reporting requirement specified by OA Scholarly journals in Biomedical Sciences?
3. What types of infrastructure are built or promoted by OA Biomedical scholarly journals to support reproducibility-enhancing documentation?

Statement of Purpose

The purpose of this study is to analyze the reporting requirements and guidelines of OA biological and medical science referred and peer-reviewed scholarly journals. By analyzing the text in the author guidelines for manuscript submission, this study aims to make an empirical contribution on how OA scholarly journals address reproducibility-enhancing practices.

METHODOLOGY

Ulrich's International Periodicals Directory (Ulrichsweb.com) is one of the single largest global authoritative databases that is used to identify serials and periodicals in a wide range of fields, including peer-reviewed and referred journals. Ulrichsweb is an easy to search source of detailed information on more than 300,000 periodicals (also called serials) of all types: academic and scholarly journals, e-journals, peer-reviewed titles, popular magazines, newspapers, newsletters, and more (Meeks, 2018).

Using Ulrich's database, a search was made to identify and retrieve open access scholarly journals in Biological Sciences. For subject areas, Ulrich's database treat 'Biological Sciences and Agriculture' together and that is the subject category selected. Accordingly, the following search syntax produced 186 active open access scholarly journals in the Biological Sciences and Agriculture. English language is selected as the language of text for the journals retrieved, and the Journal Citation report is also checked as a filter to retrieve highly rated journals. The following is the syntax of the search and number of results returned:

186 results for: Status:("Active") Serial Type:("Journal") Content Type:("Academic/Scholarly") Subject Areas:("Biological Sciences and Agriculture") Key Feature:(+"Refereed/Peer-reviewed" +"Available Online" +"Open Access" +"Journal Citation Reports") Language of Text:("English")

The search results were exported into Excel spreadsheet to further filter the top Biology (all aspects from Botany to Zoology) journals that are flagged both 'referred' and 'peer-reviewed' and that resulted in 27 journals. The Appendix summarizes the 27 journals selected for the analysis.

The website of each of the 27 open access journals were visited to extract the text provided in the 'Information for Authors' or 'Guide for Authors' section focusing on the 'materials and methods', 'preparing your manuscript', and any section that addresses transparency and reproducibility-enhancing practices. Assumption is made that authors will follow guidelines and instructions provided while preparing their manuscripts.

In order to find common baseline criteria, in addition to respective journals guidelines and reporting requirements, attempt is also made to review guidelines by institutions that are in the forefront of advancing reproducibility research, such as the NIH Principles and Guidelines for Reporting Preclinical Research https://www.nih.gov/research-training/rigor-reproducibility/principles-guidelines-reporting-preclinical-research. As a result, one more requirement, COI or competing interests, is added to the 'Guidelines for Transparency and Openness Promotion (TOP) in Journal Policies and Practices', or 'The Top Guidelines' in short was used (Center for Open Science, 2021) to assess transparency and reproducibility in the 27 selected OA biological science journals.

The Top Guidelines has eight transparency standards, but only the first seven are used for this study as the eighth standard is applicable for replication research that's beyond the scope of this study. As noted above, from other reporting guidelines and requirements, conflict of interest or competing interests is added as one criterion to evaluate reproducibility-enhancing practices. Hence, a synthesized summary of the eight standards is provided below:

1. Citation - citation of articles is routine and well-formulated. Similar standards can be applied to citation of data, code, and materials to recognize and credit these as original intellectual contributions.

2. Data transparency - for published articles, whether or not data is available and, if available, how to access it, or data must be posted to a trusted repository, or exceptions to sharing data for legal or ethical reasons must be stated to the editor at the time of submission.
3. Analytic methods (code) transparency - for published articles, whether or not program code is available and, if available, how to access it, or provide program code, scripts, codebooks, and other documentation sufficient to precisely reproduce all published results or provide software and other documentation that will precisely reproduce all published results.
4. Research materials transparency - for published articles, whether or not research materials are available and, if available, how to access it, or materials used to conduct the research are clearly and precisely documented and are maximally available to any researcher for purposes of reproducing the results or replicating the procedure, or all materials supporting the claims made by the author must be made available to the journal prior to publication, exceptions to sharing materials for legal or ethical reasons must be stated at the time of submission.
5. Design and analysis transparency - standards for reporting research design and analysis should maximize transparency about the research process and minimize potential for vague or incomplete reporting of the methodology.
6. Preregistration of studies - is a means of making research more discoverable even if it does not get published. By encouraging or requiring preregistration, journals increase the likelihood of discoverability of research that is not ultimately published.
7. Preregistration of analysis plans - certifies the distinction between confirmatory and exploratory research. Preregistration of analysis plans supersedes preregistration of studies.
8. Conflict of Interest, or, competing interests – disclosing any actual or perceived conflicts of interest or financial interests on the part of author/s that might raise the question of bias in the work reported.

RESULTS AND DISCUSSION

Results

To answer the research questions, the text from the 'instructions for authors' or 'Guides for Authors' of the 27 OA peer-reviewed journals were individually examined to determine the extent to which the journals promote reproducibility-enhancing practices; to identify specific reporting requirements; and to understand allied infrastructure developed by the journals or third-party tools & technologies used to document, preserve, and share artifacts accompanying published works.

RQ#1: To what extent open access scholarly journals in Biological Sciences promote reproducibility-enhancing research standards?

The grid below (Table 1) presents data collated from each of the 27 OA journals evaluated based on the 8 standards to determine whether the journals require the reporting standards. The eight standards correspond to the list provided above in the 'Methodology' chapter. In the grid '1' means Yes, the Journal requires authors to meet those standards; and '0' means No the journal doesn't require the corresponding standards.

RQ#2: What are the standards in reporting requirement specified by OA Scholarly journals in Biological Sciences?

Table 1. Top biomedical OA journals and their requirements to promote reproducibility-enhancing practices

Journal Name	Standard #:							
	1	2	3	4	5	6	7	8
AOB Plants	1	1	0	0	0	0	0	1
Biology Open	1	1	1	1	1	0	0	1
BioMed Central Bioinformatics	1	1	1	1	1	0	0	1
BMC Biology	1	1	1	1	1	0	0	1
BMC Biotechnology	1	1	1	1	1	0	0	1
BMC Genomic Data	1	1	1	1	1	0	0	1
BMC Genomics	1	1	1	1	1	0	0	1
BMC Mol. and Cell Biology	1	1	1	1	1	0	0	1
BMC Plant Biology	1	1	1	1	1	0	0	1
BMC Zoology	1	1	1	1	1	0	0	1
Cell Discovery	1	1	1	1	1	1	1	1
EMBO Molecular Medicine	1	1	1	1	1	0	0	1
European Jnl of Cell Biology	1	1	1	1	1	0	0	1
Frontiers in Plant Science	1	1	1	1	1	0	0	1
Frontiers in Zoology	1	1	1	1	1	0	0	1
Genome Biology	1	1	1	1	1	0	0	1
Jnl of Biological Chemistry	1	1	1	1	1	0	0	1
Journal of Marine Sciences	1	1	1	1	1	0	0	1
Journal of Plant Interactions	1	1	1	1	1	1	1	1
Marine Biodiversity Records	1	1	1	1	1	0	0	1
Microbiology Open	1	1	1	1	1	0	0	1
New Disease Reports	1	1	1	1	0	0	0	1
Nucleic Acids Research	1	1	1	1	1	0	0	1
Open Biology	1	1	1	1	1	0	0	1
Plant Biotechnology Journal	1	1	1	1	1	0	0	1
PLoS Biology	1	1	1	1	1	1	1	1
PLoS Computational Biology	1	1	1	1	1	1	1	1

Across the 27 journals selected in this study, the text from the section on 'Instructions for Authors,' or 'Guides for Authors' is examined and coded to determine the most frequently occurring themes used to address each of the eight standards used in this study. The list below presents the most common standard statements required by the journals for submission and reporting purposes:

On Citation

- We have endorsed the FORCE11 Data Citation Principles. Data must be cited in the same way as article, book, and web citations and authors are required to include data citations as part of their reference list.
- Data citations should include a persistent identifier (such as a DOI) and should ideally be included in the reference list.
- Citations of datasets, when they appear in the reference list, should include the minimum information recommended by DataCite and follow journal style.

On Data Availability

- Must indicate where the data described in the manuscript are located. For datasets that were deposited into a publicly accessible repository, the location and identifying information (i.e., accession numbers or DOIs) must be provided.
- Authors must provide access to the data underlying the results presented in their article.
- All datasets on which the conclusions rely should be either deposited in publicly available repositories (where available and appropriate) or presented in the main manuscript or additional supporting files whenever possible.
- All data and related metadata underlying the findings reported in a submitted manuscript should be deposited in an appropriate public repository, unless already provided as part of the submitted article.
- The data should be FAIR—findable, accessible, interoperable, and reusable—so that other researchers can locate and use the data.

On Materials Availability

- If the study characterizes the activity of new compounds, compound structures and the protocol for obtaining the compound must be provided.
- Materials and Methods descriptors - e.g., reagents including enzymes, antibodies, kits, specialized commercial instruments, non-standard chemicals, peptides, recombinant proteins, et al. with reference to company name, location, and catalog # must be provided.
- Explicitly requires that authors will provide, for non-profit research, all the biological and chemical materials not commercially available, including all plant cultivars, cell lines, DNA, antibodies, and other similar materials, that are used for the experiments reported.

On Code, Program, Software, Statistical Analysis

- Software code should be archived in a repository that can assign it a DOI and the DOI should be provided.
- Make the program accessible as a web server with no login requirements, deposit the source code in a public repository such as GitHub, or upload an executable version of the program and instructions as supplementary data.
- Software must be freely available to users at the time of submission, either as executable versions for multiple, common platforms (Linux, Windows and MacOS) or as source code or as a web server.
- Statistical Analyses: Details to mathematical evaluations for quantifying accuracy, sensitivity, and reproducibility should be included, indicating equation choice and numbers of replicates.
- Source code for any in-house scripts that are used for analyses must also be either deposited in a public repository or included in the supplementary materials.

- Provide all code used to generate statistics & generate figures, along with any (processed) data required as inputs, along with details of what software it requires (program and version)

On Design, Methods, Protocols

- Describe the overall experimental design briefly but with sufficient information to permit a qualified reader to repeat the experiments.
- Include the DOI link in the Methods section of your manuscript using the following format provided by protocols.io: https://dx.doi.org/10.17504/protocols.io.[PROTOCOL DOI]
- Experimental procedure described in a manuscript would benefit from a step-by-step protocol, submit detailed protocols for peer review and publication in Bio-protocol or to deposit them at protocols.io.
- In exceptional cases where the materials and methods are particularly lengthy, more detailed experimental protocols or descriptions of computational analyses may be included as supplementary materials and methods (though all methods must be mentioned in the main text).

On Pre-Registration of Studies

- You should always ensure that you register protocols for clinical trials you're involved with in a publicly accessible registry.
- Authors are encouraged to indicate whether the conducted research was preregistered in an independent, institutional registry.
- Preregistration of studies involves registering the study design, variables, and treatment conditions prior to conducting the research.

On Pre-Registration of Analysis

- Authors are encouraged to indicate whether or not the conducted research was preregistered with an analysis plan in an independent, institutional registry.
- Preregistration of analysis plans include specification of sequence of analyses or the statistical model that will be reported.
- Nature Portfolio journals support pre-registration of analysis plans in public repositories; details of pre-registration should be provided with submission.

On COI, or Competing Interests

- In the interests of transparency and to help readers form their own judgments of potential bias, corresponding authors are required to declare any competing financial and/or non-financial interests in relation to the work described.
- Must include a statement disclosing whether there are any actual or perceived conflicts of interest on the part of any author.
- In the submission system, declare on behalf of all authors whether there are any financial, personal, or professional interests that could be construed to have influenced the work.

RQ#3: What types of infrastructure are built or promoted by open access scholarly journals to support reproducibility-enhancing documentation?

While most of the journals don't have the required Infrastructure built within their publishing workflow, they require or recommend authors to link to third-party tools and technologies where research assets are deposited, shared, and archived, and documented. These research assets are critical to support the management, publishing, archiving, sharing, discovering, version control, and overall documentation of the scholarly communication process, and hence enhance reproducibility. Representative infrastructure that the journals recommend include the following:

- For protocol registration - Bio-protocol, Protocol.io, International Clinical Trials Registry Platform (ICTRP)
- For OA license - CC-BY Creative Commons attribution license
- For research registration -Crossmark for clinical trials, OSF.io, clinicaltrials.gov, Crossref
- For publicly available data repositories - Zenodo, figshare, GenBank, Mendeley Data
- For depositing nucleotide sequence data - DDBJ, EMBL, or GenBank
- For depositing confidential human data – dbGaP, dbSNP, European Genome-phenome Archive EGA
- For persistent data, protocol, and research identifier - DOI
- For data citation - FORCE11, DataCite
- For code, software archiving / sharing - GitHub, Zenodo, CodeOcean, Software Heritage archive
- For COI, funding registry - Open Funder Registry Crossref funder registry
- For authors identification - ORCID

DISCUSSION

From the data presented above it is evident that almost all the 27 journals investigated in this study support reproducibility enhancing practices. The only 2 standards that are sparsely addressed are: 1) Pre-registration of studies; and 2) Pre-registration of analysis plans. The emphasis on 'data availability' requirement by these journals confirms the prevailing consensus that 'no data, no science' (Miyakawa, 2020) as key requirements for enhancing reproducibility.

RQ#1: To what extent open access scholarly journals in Biological Sciences promote reproducibility-enhancing research standards?

Analysis of the reporting requirements text from the 'Instructions for Authors' or 'Guides for Authors' sections of the 27 journals reveal that while six of the eight reproducibility-enhancing standards are clearly specified, two standards, i.e, 1) preregistration of study, and 2) preregistration of analysis plans; were addressed only in 5 of the 27 journals. The five journals that address all the eight standards are: 1) Cell Discovery, 2) Journal of Marine Science, 3) Journal of Plant Interactions, 4) PLoS Biology, and 5) PLoS Computational Biology. In addition, strong emphasis is placed by all journals on 'data availability' as a must for submission. The kinds of infrastructure suggested and promoted by these journals as part of the scholarly communication workflow range from data, code, software repositories, protocol registration, to funding registry. There is no single journal that has built a complete infrastructure for all research assets in its publishing workflow system. The journals usually enhance submitted reports by adding metadata and linking to various endpoints to their-party tools and technologies.

While individual variations exist across the 27 journals in terms of how exhaustively they address the submission requirements, it is evident that almost all open access biological sciences journals investigated in this study require reproducibility-enhancing practices. This is also a testament to how far open access journals have come in the overall scholarly communication ecosystem.

RQ#2: What are the standards in reporting requirement specified by OA Scholarly journals in biological sciences?

In the 'Information for Authors', or 'Guides for Authors' sections of Author Guidelines in each of the 27 selected journals, specific attention is given to the text under 'preparing your manuscript' sections with particular focus on 'data availability', 'materials and methods', 'experimental procedures', 'research design', and 'funding disclosure or competing interests' sections of the journals. Some of the journals promote stringent requirements and offer detailed guidelines, while others require the minimum standards necessary to interpret the findings of the study. At a minimum almost all journals require data availability and sufficient description of research design.

On the other spectrum, for example the 'Journal of Plant interactions,' provides robust guidelines starting from - Declarations and ethics statements- where prior to starting the study, ethical approval must be obtained, and that all studies involving humans are performed in accordance with the principles stated in the Declaration of Helsinki, and (when applicable) informed consent from participants is voluntarily obtained in accordance with the principles outlined in the Nuremberg Code, the Belmont Report and the American Anthropological Association.

Another example that demonstrates stringent and detailed guideline is found in the journal 'Nucleic Acid Research (NAR).' In NAR, for example, when depositing data involving human participants, authors must ensure that all datasets have been de-identified and anonymized in accordance with the Safe Harbor method before submission. If needed, a trusted third party can be used to convert personal data into anonymized data, or NAR recommends appropriate databases for depositing confidential human data. In general, other than lack of policy and standard guideline in the two areas, i.e., 1) preregistration of studies; and 2) preregistration of analysis plans; all the 27 journals have clear statements that require authors to address reproducibility-enhancing practices on the remaining six areas: data citation; data availability; material availability; sharing code, program, software, and statistical analysis; details of research design, methods, and protocol; and disclosure of conflict of interest.

In addition to a must have 'data availability' policy, the research design, materials, and methods section requirement is given great significance in reproducibility-enhancing research. When it comes to the overall research design, the standard requirements by many of the journals address standards such as - detailed reporting instructions of actual experimental design including: the exact sample size (n) for each experimental group/condition; a precise description of the sample collection allowing the reader to understand whether the samples represent technical or biological replicates (including how many animals, litters, cultures, laboratory replicates, etc.); if comparisons are made between groups, a clear description of the method used for statistical inference; for the analysis of categorical outcomes, exact methods or asymptotic methods with appropriate adjustments for small sample size; standard chi-squared or difference in proportions tests for large sample sizes; t-tests for comparisons of continuous data that are normally distributed data to compare two groups; Analyses of Variance (ANOVA) for comparisons between three or more groups; and If p-values are presented, one-sided or two-sided should be specified, and if one-sided, justification should be provided.

RQ#3: What types of infrastructure are built or promoted by open access scholarly journals to support reproducibility-enhancing documentation?

To support documentation and sharing of research assets such as data, codes, protocols, etc., the biological sciences journals sampled in this study recommend tools and technologies (mostly third-party, outside of the respective publishing platforms of the journals). The journals then provide links to the various endpoints of the research assets for easier identification and discovery. This can be often

challenging for authors to jump from one system to another to deposit and share the different research assets from data to codes/scripts, to material, and to protocol, and funding registry. It would be easier and more streamlined if journal publishers provide a one-stop platform during the manuscript submission process for authors to weave and compile the manuscript and all accompanying assets that are required to promote reproducibility. The goal should be towards automated submission process that also ensures long-term preservation of the different artifacts of the research work. In this regard assigning persistent or permanent identifier such as DOI for the different research assets, as well as the proper documentation and adequate description of data, materials, statistical methods, analysis, scripts, software, are critical to further enhance reproducibility research.

FUTURE RESEARCH DIRECTIONS

There is no question reproducibility-enhancing research practices are critical for the advancement of science and scientific knowledge, in general. This chapter showed open access scholarly journals in biomedical sciences, to a large extent, have built reporting requirements that adhere to reproducibility-enhancing practices. However, the overall workflow, from pre-registration to submission, is made up of independent and third-party tools and technological infrastructure outside of the specific journal manuscript submission system. To hop from one system to another to document analysis steps, register protocols or conflict of interest, and/or deposit associated research assets such as data is often daunting for researchers that can easily result in less-optimal documentation and reporting standards that in the end will have adverse effects on reproducibility.

To minimize the additional time and effort required of researchers to comply to reproducibility-enhancing research practices, it is prudent if journal publishing systems investigate a one-stop platform that supports the overall research workflow from start to completion. This could mean easy porting of manuscripts author computer to publication submission system, or built-in software to author manuscripts, codes, analysis, and easy linking to additional research assets that in the end can be compiled to generate a well documented report. In addition to time and effort, it is important to consider the long-term preservation and version control dimensions of published works.

CONCLUSION

The implications of this study are in advancing the synergy between open access publications and reproducibility-enhancing research practices. Both open access and reproducibility share overlapping goals, i.e., wider dissemination, openness, verification, transparency, and establishing the integrity and ethical conduct of research, especially those involving human subjects. Outside of open access scholarly communication, it is equally important if journals and scholarly publications behind paywalls consider to promote reproducibility by opening access to critical research artifacts such as data, software, code, and analyses, for rigorous verifications.

Top open access biomedical sciences journals are investigated to determine the extent to which their reporting requirements advance reproducibility. These reporting requirements are evaluated against the most comprehensive reproducibility-enhancing standards developed by the Center for Open Science called ‘Guidelines for Transparency and Openness Promotion (TOP) in Journal Policies and Practices,

or the Top Guidelines,' in short. As stated in the results and discussion sections, 22 of the 27 journals address six of the eight standards used in this study. To facilitate reproducibility, the journals sampled in this study specify key standards and guidelines in their 'Information for Authors,' or 'Guides for Authors' sections of the submission process. Because they contain all key essential elements included in the TOP Guidelines, the journals such as 1) PLoS Biology; PLoS Computational Biology, and Journal of Plant Interactions, and Cell Discovery, and Journal of Marine Science should be used as benchmark for other journals to follow suite.

As discussed above, OA biomedical sciences journals, in their manuscript submission guidelines, explicitly promote transparency and reproducibility. Some journals, for example 'Open Biology', go as far as asking authors to complete a reporting form that will be made available to editors and reviewers during manuscript assessment. The form will be published alongside all accepted manuscripts. The reporting form covers details such as information about their experiments, analyses, or data collection within the Materials and Methods and/or figure legends, to ensure that readers can easily understand what was measured and analyzed and can accurately perform the relevant protocols.

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KEY TERMS AND DEFINITIONS

Computational Reproducibility: Obtaining consistent results using the same input data; computational steps, methods, and code; and conditions of analysis.

Gold Open Access: Open access delivered by journals.

Green Open Access: Open access delivered by repositories.

Inferential Reproducibility: The drawing of qualitatively similar conclusions from either an independent replication of a study or a reanalysis of the original study.

Methods Reproducibility: The provision of enough detail about study procedures and data so the same procedures could, in theory or in actuality, be exactly repeated.

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

Reproducibility: The ability of a researcher to duplicate the results of a prior study using the same materials as were used by the original investigator.

Results Reproducibility: Obtaining the same results from the conduct of an independent study whose procedures are as closely matched to the original experiment as possible.

Scholarly Communication: The system through which research and other scholarly writings are created, evaluated for quality, disseminated to the scholarly community, and preserved for future use.

TOP Guidelines: A suite of tools to guide implementation of better, more transparent research.

APPENDIX

Top peer-reviewed and referred OA biomedical sciences journals

1. AOB Plants	10. BMC Zoology	19. Journal of Plant Interactions
2. Biology Open	11. Cell Discovery	20. Marine Biodiversity Records
3. BioMed Central Bioinformatics	12. EMBO Molecular Medicine	21. Microbiology Open
4. BMC Biology	13. European Journal of Cell Biology	22. New Disease Reports
5. BMC Biotechnology	14. Frontiers in Plant Science	23. Nucleic Acids Research
6. BMC Genomic Data	15. Frontiers in Zoology	24. Open Biology
7. BMC Genomics	16. Genome Biology	25. Plant Biotechnology Journal
8. BMC Molecular and Cell Biology	17. Journal of Biological Chemistry	26. PLoS Biology
9. BMC Plant Biology	18. Journal of Marine Sciences	27. PLoS Computational Biology

Chapter 7
The Role of Open Access in Enhancing Equitable Curricula and Research Outputs: Global Context

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ABSTRACT

When educators have difficulty accessing peer-reviewed research, it is inequitable to expect them to compete with educators who have access to a plethora of resources. Inequities have been a historically-identified educational problem; however, the forced online learning that occurred during COVID-19 restrictions amplified discrepancies experienced by tertiary educators. Scholars who were forced to work without strong information communication technologies infrastructure and who experienced limited access to online resources struggled more than those that had 24-hour uninhibited access. Education came to a near standstill for those that could not easily move their activities online. Prior to the pandemic, individuals working with curricula were already feeling handicapped by the lack of access. When physical libraries were closed, it became nearly impossible for many to move forward. This chapter explores the changing publishing paradigms, particularly the role of OA and how increasing open dissemination of scholarly outputs can reduce inequities in curricula and research activities.

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INTRODUCTION

Educators and researchers continue to adapt to the changes in how scholarly works are published, disseminated, and retrieved. Gone are the days of publications being housed predominantly as print copies of journals and books shipped directly to institutions, organizations, or individuals and stored on library shelves where researchers would spend full days looking through stacks to find specific articles, chapters, or books. Now most educators, researchers, and students use online databases to access digital resources; a process that can be done from anywhere in the world if the correct mechanisms are in place and available for individuals attempting to gain access.

Unlimited and unrestricted access to high quality scholarship is a critical component for effective and efficient curricula building and research in most disciplines. For educators and researchers in developed countries this access is almost a given; something often taken for granted. However, this is not the case for many educators who find themselves in less developed or lower-income countries. For these individuals, attempting to gain access to the desired and even required scholarship is an ongoing challenge.

In high income countries, educators and researchers may occasionally come across an article, chapter, or book that their library does not have immediate access to, and they run into a paywall. Most of these individuals have contacts and resources available to find a free way to gain access. Whether it is through an interlibrary loan, because their library is a part of a larger network, a colleague at another institution who has access, or some other means, this situation is resolved and the article, chapter, or even book are obtained and thus become available for use. This is not the case for individuals in low- and middle-income countries (LMIC). These educators and researchers come across such resource restrictions more often due to the limited nature of their online libraries, and when they do experience such obstacles, they do not always have contacts and resources as readily available to assist them. This increases the chances that they will not gain access to the specific resources they seek.

When educators and researchers struggle to obtain the literature they need, it is not only frustrating, but it can also cause some individuals or even whole departments to be unable to complete the goals they have set for high-quality reviews and even for the foundational grounding of their own studies in the current literature. This may cause scholars to use limited or lower quality articles that are not quite as on target as ones that are blocked behind a paywall. The very nature of educational pursuits depends on access to established knowledge. When peer reviewed research is inaccessible or locked away for only certain privileged scholars, we are perpetuating not only the uneven distribution by blocking the less privileged from working with the information, but also blocking production of future research that could enhance areas of knowledge. This is a concern of equity, social justice, and epistemic justice.

The working definition of social justice to be used in this chapter comes from work examining Open Education, however, also applies in the context of Open Access (OA). The preferred definition of social justice is: "A process and also a goal to achieve a fairer society which involves actions guided by the principles of *redistributive* justice, *recognitive* justice or *representational* justice" (Lambert, 2018, p. 227). These principles will be explored later in this chapter with specific emphasis to issues and potential impacts, as well as the need for OA in particular. As to the understanding of epistemic justice, Fricker (2013) explains this as an area of philosophy that either values or devalues the ability of individuals or groups to be knowers. She goes on to explain that *distributive epistemic injustice* takes place when there is, "an unfair distribution of epistemic goods such as education or information" and further articulates that *discriminatory epistemic injustice* includes situations where individuals or groups experience a "deficit of credibility" and thus experience prejudice when sharing information (Fricker, 2013, p.1318). Both

types are experienced in the case of scholars from LMICs, distributive when there is a lack of access, and discriminatory, when there are undue challenges or even an inability to produce and disseminate scholarly works.

When COVID-19 became a global pandemic in 2020, issues of equity became even more pronounced and amplified. The 2nd Open Science Conference organized by the United Nations in July 2021, saw policymakers, intergovernmental organizations, librarians, publishers, and research practitioners engage in a public dialogue focusing on what Open Science has learned from COVID-19 and how this can be applied to actions addressing the global crisis, at the interface of science, technology, policy, and research. The conference seized the opportunity to collect lessons learned, and identify directions for the way forward, including equity in open scholarship.

During the pandemic restrictions, educators and researchers with access to the Internet, an academic library or resources via OA could continue to obtain materials and move forward with curricula and investigations. Those in locations without the same level of access were limited, if not stopped entirely, from continuing their work. It became apparent that institutions in high income countries were much better equipped than those in LMICs to successfully navigate 100% online teaching and learning activities. Prior to COVID, many scholars could gain access to scientific data if they could simply get to the brick-and-mortar library building, but with COVID restrictions, this was no longer an option as most campuses were shut down completely. Consequently, many programs and initiatives, including collaborative projects in LMICs experienced a complete cessation of activities as online access was limited or unavailable.

When considering equity in access, it is important to also consider educators, researchers, and practitioners who are not employed by institutions of higher education and therefore do not have ongoing access to an academic library. These individuals are often restricted to resources they can access online or those they can obtain if they are fortunate enough to live or work geographically close to a university campus where they can visit and obtain the desired scholarly resources. Keep in mind that physical access has major limitations even for affiliated members, limitations that were highlighted with COVID-19 restrictions.

Whereas the circumstances surrounding COVID-19 amplified the inequities in access, it also highlighted the benefits of opening up access to resources to solve a common problem. In this regard, very soon after the world realized we were experiencing a global event, researchers were encouraged to share their COVID-19 related research and data openly (Tavernier, 2020), with the hope of quickly developing preventative measures, including a vaccine. Many researchers began to forgo the traditional publishing model and share their research through open platforms (Tavernier, 2020). The wide dissemination of data and findings aided in the development of a vaccine much quicker than would have happened without this shift in norms.

This opening up of scholarly communication does not come without concerns and challenges, many of which are discussed in this chapter. However, even during non-pandemic times, OA can save time, effort, and possibly finances for educators and researchers who would not be forced to gain access through physically going to a research library, through having to find a way around paywalls, or through choosing to pay what are sometimes very high fees to read scholarly literature. The proponents of OA argue that it helps improve scholarly communication by disrupting the way things have been done with traditional scholarly publications. “Researchers need to be able to access, read, test, augment, refine, and refute each other’s work – that is the way research moves forward” (Pinfield et al., 2020, p. 258).

In this chapter, a brief overview of OA will be provided. Then a deliberation of OA's role in equity and social justice will be discussed to show a clear link between the two. OA has the potential not simply to assist in narrowing the existing gaps but also in equalizing areas of inequities within curricula building as well as research activities. However, the current identified injustices should be considered so as not to perpetuate or even exacerbate the exclusion of scholars from LMICs.

BACKGROUND

This section will begin with a description of the general concepts of OA and then move on to a review of the different types. One critical point to be clarified is that OA is a type of publication leading to free access for the consumer. OA is not a type of content, but rather the means of dissemination of content. OA can also be referred to as Open Scholarship, and can consist of articles, books, data, digital media, notebooks, software, etc. Although much of the material covered in this chapter can apply to several types of content, the focus is on scientific outputs that share empirical research, and review, analyze, and synthesize available literature.

An overview of OA starts with examining the funding paradigms. Even though OA is without a cost to the consumer, costs are still incurred and must be paid by someone. Often the users of scholarly publications are only aware whether or not they can gain access to the source they seek, and they are unaware of how the publication costs were met. Prior to the emergence of OA, the majority of scholarly publishers operated on a subscription model where the cost of publication was mainly covered by institutions, organizations, or individuals who subscribed to the print or more recently the online versions of journals. In the case of books, the purchase was paid for by the consumer in a similar manner. As new publishing models emerge, the types of OA can be distinguished by who pays the publication costs. Currently, existing OA models include but are not limited to Gold, Green, Hybrid, Diamond, and Bronze. For the purposes of this chapter, two of the most popular will be discussed, Gold and Green. Additional jargon surrounding OA publication is defined in the glossary of terms.

Gold OA is normally funded through Author Processing Charges (APC), where the authors, the authors' institutions, or funders pay the publisher to disseminate the articles in an open access format, so readers can gain access freely without incurring a charge. Some traditional publishers that have moved to OA require APCs for every publication; however, some publish by traditional means with an option to make the manuscripts available through OA when the APC is paid; this can be known as a form of Hybrid.

Green OA consists of scholarly publications made available by the authors through their institutional repositories, academic discipline repositories, societies, associations, professional organizations, etc. Authors posting in Green OA do not incur charges to make their work available, however, they must be aware as to whether or not they can legally do so based on agreements they have made with publishers. Sometimes authors post Green OA articles as pre-prints before the published article is available, however many are posted as fully peer-reviewed articles. The articles that are posted as peer-reviewed may have an embargo period by the publisher, which vary based on policies.

Several nuanced differences exist with specific publishers and the contracts they offer, however, the key distinguishing factor between Gold and Green OA is that for Gold, money must be paid to a publisher and for Green such a payment is not required. It is imperative to point out that even with the move to OA, commercial and university publishers, who are almost entirely living and working in high income countries, often control what studies are published. Such approaches, directly or indirectly, intention-

ally, or unintentionally, limit or close out scholarly communication from scholars from LMICs (Roh et al., 2020). The use of APCs often excludes scholars who are unable to pay the fees, and according to Nkoudou (2020), making this model exclusionary, and a form of discriminatory epistemic injustice. OA would be more socially just if mechanisms were in place to not only allow researchers from LMIC to access published research but also make it possible for them to publish and add their voices to the global conversations in their fields.

Challenges and Misconceptions

As with any new innovation, OA faces both challenges and misconceptions. These warrant entire chapters or books, therefore the information covered here is barely touching the surface. Concerns include those about the quality of OA publications, the concept of OA as a viable means of publication for promotion and tenure, confusion surrounding copyright laws, lack of knowledge and participation in institutional repositories, and the concerns about commercial use of research outputs.

Quality of OA Publications

When discussing the quality of OA, there is a misconception that OA automatically means low quality. This is based on inaccurate assumptions that OA manuscripts are not peer-reviewed. Many OA publishers still have rigorous peer-review processes, and just as with traditional publishing, many of these are still high quality. If an article is posted as a preprint, it may or may not be peer-reviewed, but preprints are only one source of OA and many preprints indicate if they have been peer-reviewed or not. If a preprint has been accepted by a peer-reviewed journal this may indicate that it has already been peer-reviewed. Many OA articles, such as those published by Gold OA, have been fully peer-reviewed. Other alternatives to traditional peer-review are emerging. These include open-peer review which entails a significant publication paradigm shift (Tennant et al., 2019).

OA publications are also being monitored for quality outside of traditional peer-review as can be seen when claims being made in articles are challenged by others in the field. During the early stages of COVID-19 when scientists were being encouraged to share their work openly, there were community calls to remove an OA article from the Internet that contained false information about the virus (Tavernier, 2020). This is an example of a form of peer-review which could be developed in other areas of science as an organic system of checks and balances. This could encourage skeptics to embrace OA as a viable, high-quality method of disseminating scientific findings. It could be argued that there are plenty of other worldwide disasters and disruptions that could be alleviated or at least lessened with the open sharing of knowledge through OA.

OA as Records for Promotion and Tenure

In addition to the concerns about quality, academic researchers around the world are still not considering OA as a first choice in publication due to the lack of value placed on such publications to build a portfolio to be used for promotion and tenure. In other words, if authors need publications for promotion and tenure they may seek a traditional publisher that is also a high-ranking journal. Many OA journals are still not considered high-ranking (Wical & Kocken 2017). This challenge could be addressed through policies put in place by institutions that accept and even encourage publishing in OA. Change in this

area is hard in general, and for certain disciplines in particular. Institutions could also help pay author processing fees to encourage Gold publishing by their faculty and students with well-established traditional publishers that offer this option. More will be discussed about possible institutional initiatives in an upcoming section of this chapter.

Confusion about Copyright

Much confusion surrounds the legal issues of OA, particularly for authors that wish to post their works on Green OA platforms but are concerned about breaking copyright laws. Authors are not the only ones confused, editors are also often unclear on policies and pass the buck back to the publishers (Roehrig et al., 2018). Confusion about copyright issues, embargo periods, authors ability to share their own work, etc., (Tennant et al., 2019), could be alleviated by training and pushing past the fear of the unknown. Institutions could have liaisons to assist authors as they encourage OA participation. More will be covered in the section on social justice and stakeholders.

Knowledge about OA and Institutional Repositories

OA directly impacts knowledge management and makes scholarly resources available to a wider population of researchers, educators, and practitioners. However, there remains a lack of knowledge about its existence and how to access OA resources, particularly the use of institutional repositories. Several studies have been conducted about knowledge of and participation with OA and institutional repositories with mixed results (Bala et al., 2018; Fussy, 2019; Hoskins, 2020; Ofori & Pomfowaa, 2020). Findings show that many institutions still do not have institutional repositories and that even with those that do, scholars are unaware of the resources made available. This lack of repositories and/or lack of knowledge about repositories is amplified in some LMICs (Fussy, 2019).

As to posting research in institutional repositories, some scholars argue posting one's work as preprints could allow others to 'steal' the idea or negatively affect peer-reviews. Actually, preprints protect against the theft of ideas by documenting authorship of studies before they have been published in peer-reviewed journals which can take a lot of time (Tennant et al., 2019). The effect preprints can have on peer-review is an area that needs more exploration, particularly in disciplines that are small, and where researchers may be familiar with their colleagues' work (Fleming et al., 2021). More education on the topic of OA and an increased use of preprints and institutional repositories could alleviate this challenge.

Commercial Use of Information

The concern about predatory publishing and the commercial use of information are both valid. Predatory open-access publishing is an exploitative open-access academic publishing business model that involves charging publication fees to authors without providing the editorial and publishing services associated with legitimate journals. Other legitimate concerns have been highlighted about journals being mislabeled as predatory, particularly those from LMICs that happen to charge APCs but are not actually predatory (Roh et al., 2020). As OA becomes increasingly popular, less confusion and misinformation will surround this form of publication and these concerns will decrease (Nobes & Harris, 2019; Tennant et al., 2019). Also, as OA expands, and more stakeholders become invested in its success, knowledge

and correct information will make it more difficult for either of these problems to exist as policies are put in place for prevention.

The challenges of OA should be examined in light of the benefits that carry much more weight. Many of the challenges are temporary and will be alleviated through the sustained education, use, and expansion of OA. OA allows for increased global exposure for scholarly outputs. Consumers are increasing and include individuals who have not had access to subscriptions to elite academic journals that have traditionally been locked behind paywalls. The benefits of OA will be described throughout the remainder of this chapter through the lens of social justice and equity for educators, researchers, and society in general.

THE SOCIAL JUSTICE PRINCIPLES AS APPLIED TO OPEN ACCESS

While social justice is not a new concept, it has rightfully gained a spotlight over several decades and is linked increasingly to a wide array of issues. Countries that claim to be fair and equal for all people are continually being challenged to assess their actions against the premises of social justice. Institutions of higher education are also being challenged as producers of knowledge for general good to open up their scholarly outputs. The framework of social justice could be applied to participating and promoting opening access to scholarly outputs (Raju et al., 2020). One could argue that a movement to open access to scholarly literature, whether at the institutional level or the governmental level, is not significantly different from the ongoing global movement to open education to all as a human right. Raju et al. (2020) suggest a movement to "library as publisher" to further shift the paradigm associated with OA and make publication less challenging for those that have difficulty with traditional or commercial OA publishing. This concept will be further explored in the section on producers.

Social justice is based on various principles, including but not limited to, redistributive, recognitive, and representational (Lambert, 2018). Diving deep into each principle is beyond the scope of this chapter; however, a brief description of each and an overview as to how each of these three principles can be addressed through OA will be provided. Redistributive social justice refers to the distribution or allocation of items. In the case of scholarly research, it would be the distribution or allocation of scholarly outputs, mainly with a focus on peer-reviewed articles that have traditionally only been accessible to scholars whose institutions obtained access through subscriptions. The recognitive principle of social justice refers to the act of recognizing entities as legitimate, and representational social justice refers to each group or individual being represented as part of the whole.

As to the redistributive principle, OA by its very nature allows scholarly literature to be made available freely to all, and therefore is distributing resources to those who might otherwise lack such access. Bacevic and Muellerleile (2018) posit that OA is a moral issue and publishing behind a paywall goes against what scholarly writing is meant to accomplish. However, OA publications need to be monitored and evaluated to ensure that these publishing mechanisms are not simply making curricula building and research easier for those that are already at the core of academia. The goal should be to ensure OA is having a positive impact for researchers and educators on the periphery and helping them get closer to the core. Effort will need to be put forth to ensure researchers and educators on the periphery are aware of and able to access the resources that are being distributed through OA.

The next two principles, recognitive and representational, should be more purposefully addressed by welcoming and, in fact, *inviting* diverse voices and views. Researchers on the periphery should be invited to participate in the production of studies that would then be distributed through OA channels.

Simply opening access to resources created by the dominant culture could perpetuate the problems by continuing to push alternative views and researchers from minority cultures to the periphery. Valetsianos (2020) argues that opening access does not always help decrease inequities and that several issues need to be considered, such as who is writing the documents and are citation politics playing a role. If the participants being studied and those conducting the research and authoring the manuscripts are not representative of all peoples, exclusion is still at work. When referencing the paradigm shift that OA brings to publishing, Ola (2018) stated, "This dynamic revolution is built essentially on a shift from egocentrism and self-centeredness that has become the norm in the society and is re-engineering a sharing structure that would bring about a balanced knowledge society" (p. 2).

OA and Social Justice: The Roles of Stakeholders

"*If you have knowledge, let others light their candles in it*." —— Margaret Fuller

Consumers

Most scholars are both consumers and producers of research outputs. However, it is helpful, to examine social justice issues as they pertain to OA from both perspectives. Consumers of scholarly work are predominantly, however not solely, academics. Opening access to educators and researchers would be beneficial, particularly to those who are challenged with gaining access to scholarly works through their institutions because their institutions are financially unable to provide such access. However, for a moment, it is important to mention other individuals who may benefit from having access to scholarly literature, such as researchers not affiliated with an institution and practitioners in a variety of fields. Since only about a quarter of scholarly literature is openly available on the Internet (Roehrig et al., 2018), these individuals without institutional access or other means of obtaining literature would be locked out of 75 percent of available research.

In many disciplines, practitioners, such as medical doctors, engineers, architects, independent educators, etc., might search databases of scholarly output for best practices and hit paywalls or otherwise be unable to get to the required or helpful literature. If these sources were open to them, they would experience fewer challenges locating documents in full-text and learning from increased options in the peer reviewed literature of their domains (Fleming et al., 2021). Practitioners and policy members need access to best practices and the latest findings to benefit the areas of practice in which they participate (Roehrig et al., 2018). OA contributes to a bridge between theory and practice, a bridge that is often considered non-existent. In many disciplines individuals from the public could also benefit from opening access.

When university affiliated individuals come across barriers to access, they can reach out to libraries for assistance. One such service libraries offer is interlibrary loans. These services can be extremely helpful when libraries have connections with several other well-equipped libraries. Not every resource is available through these methods, however, and even when a resource is available, it can take anywhere from a few minutes to months to obtain. Delays and frustrations may cause newer researchers, or even seasoned researchers, to give up on a source that might be exactly what their research needs to solidify their claims. Because not all libraries have the same access to partner institutions, this useful mechanism is still not equalizing access for all.

When researchers face obstacles in obtaining a specific article or book, they may reach out to colleagues to inquire about access to the document they seek. Many times this is helpful, however at times researchers are forced to use methods that are not standard and may be frustrating and even cross ethical lines of sharing (Heller & Gaede, 2016). This is being done not with an intention to steal anything, but in an effort to gain access to research and engage in the scholarly conversation that researchers and scholars have every right to be a part of. Many copyrights allow for this type of one-to-one sharing, however this would require those seeking access to have the social connections that have access, which many may not have.

Heller and Gaede (2016) discussed many times when researchers in LMICs run into obstacles completing research projects based on access obstacles. One example could be a researcher or group of researchers who have received a 'revise and resubmit' on a manuscript but are then unable to access the resources to fill in the gaps identified by the reviewers. In a case like this, a study that is mostly complete may go unpublished. How frustrating it would be for these researchers to have invested countless hours and limited energy and still not successfully be able to produce a publishable manuscript due to their lack of access as a consumer. For educators making similar attempts to build curricula, they are putting forth effort to construct or enhance their curricula to better equip their students and are unable to offer all they wish to provide, not due to lack of effort or expertise, but due to lack of access.

Another example could be the attempt to complete systematic reviews or meta-analyses. How can researchers in developing countries without nearly unlimited access to literature, conduct these types of studies that demand the ability to obtain all identified studies on the topic of interest? The limited access as consumers is preventing them from fully participating as members of the academic community in which they belong. Research into this phenomenon may show that these types of studies are conducted only infrequently in developing countries and when they are conducted, the quality may be affected more by lack of access than effort or ability. This is yet another way that consumers with limited access are being excluded from becoming producers and fully engaging in scholarly conversations in their fields.

Heller and Gaede (2016) stated, "Access to information is vital to success in our information economy. Individuals or whole groups of people that are unable to access information through research databases experience a distinct disadvantage" (p. 5). Many of the obstacles discussed for consumers also affect producers as it is nearly impossible to produce scholarly literature, whether for traditional publishing or for OA, if those attempting to produce cannot gain access to the research needed to ground their own work. It is important to consider that limited access, which is directly affected by limited funding, causes a few select researchers to produce the majority of research (Fleming et al., 2021). This in turn causes an Ivory Tower phenomenon rather than research being produced by a variety of individuals within each global community. One example of this is in the field of education, where research from rural researchers and schools are often left out (Tipton et al., 2019). OA can help researchers from less well-known and less funded institutions, as well as unaffiliated practitioners or policy makers, become producers by allowing them to fully examine the findings and literature in their disciplines.

Producers

The focus of this section is on the reasons producers of scholarly research choose or choose not to publish their work in OA. Keep in mind that moving from traditional publishing to OA publishing will not, in and of itself, equalize who is getting published or address the complex information access disparity is-

sues. The gatekeepers of both types of publication need to recognize and stop the exclusion of academics from the periphery, a discussion that will be expanded in the section on publishers.

Several factors are at play when researchers consider where they will publish their articles. Many choose not to publish their works in OA due to the misconceptions discussed earlier and the financial burden of Gold OA. Many are concerned about OA being predatory in nature, or the work published in OA being used commercially. Concerns for faculty researchers also include the weight of a publication in OA for tenure and promotion. When discussing how faculty choose publishers, Arunachalem (2017) stated,

(A)ll aspects of their professional career—tenure, research grants, election to fellowship of academies, invitations to conferences, getting bright students, reputation among colleagues, all of these and more—are intimately linked to the journals in which they publish and the impact factors of those journals. (p.15)

As the misconceptions are being dispelled and as increasing value is being placed on OA dissemination, authors are increasingly choosing OA as a means of publication. Authors are discovering that OA can assist in getting their work released more quickly, as they are able to promote their work prior to the release dates of some of the publishers that have historically taken months and even years. This more rapid and widespread dissemination increases impact and visibility by allowing authors to promote their work on various platforms. This in turn increases the chances of gaining citations. Since researchers work in a "reputation economy" with citations being one of the best ways to build that reputation (Pinfield et al., 2020), this aspect of OA is attracting authors who are seeing through the challenges.

In addition to the aforementioned reasons for choosing OA for publication, there is the moral reasons of making scholarly outputs open to all, as is being posited throughout this chapter. As authors are encouraged to use OA to disseminate their work and as more authors make that choice, it will become more commonplace, and the publishing norms will change. Raju et al., (2020) make a call for supportive systems to be in place throughout the continent of Africa to create a network of publishing peer reviewed studies through libraries. This could enhance or expand what is already being done with some repositories and encourage engagement with OA publishing. Raju et al. (2020) encourage "advantaged" institutions to provide the human element for editing and peer-review, as well as the platforms necessary to make this possible. They label this effort "library as publisher" and state that this could create a "seismic shift in thinking around the benefits for the production and dissemination of research" (p.60). Several South African university libraries are actively engaged in these activities, offering services of traditional publishers but without charging APCs (Raju et al., 2020). As the challenges of APCs are addressed for authors globally, regardless of their geographical and financial advantages or disadvantages, OA may become the optimal choice for authors.

Other Stakeholders When Considering Open Access

Since a large majority of research is produced from university affiliated scholars, it is critical to examine the role university administrators and policy makers can play in the promotion of OA. Research funders are another important group of stakeholders to consider as they fund research both for university researchers as well as independent researchers and those researching through organizations loosely or even unaffiliated with institutions of higher education. Finally, when examining stakeholders, the publishers

of scholarly literature must be considered, as they are directly affected by and directly influencing the movement from traditional publishing models to OA models.

University Administration and Policy Makers

Universities and colleges wield much weight in promoting dissemination of scholarly works through OA. Heller and Gaede (2016) posit that if an institution wants to be known as promoting social justice, OA is one avenue, and for those that take this route, faculty can be encouraged to be involved that would otherwise not have considered OA. McKiernan (2017) posits that in order to live out their mission statements, which include sharing information, many institutions should place a higher value on OA and making the scholarly outputs of their scholars available to the general public.

Institutional policy can encourage publishing in OA as a viable method to move toward tenure. Universities and colleges can appoint committees to assess the current policies in place for retention, promotion, and tenure (RPT) and to examine the current outputs of faculty that are or are not using OA methods. Vandagriff (2020) conducted one such study and found that, whereas peer-reviewed publications were emphasized by universities and colleges for RPT, OA was not mentioned in documentation, and neither were predatory journals. Senior researchers or tenured-track faculty could be encouraged to use their positions to publish in OA and to push for changes in their universities' tenure and promotion policies for less senior scholars (Roehrig et al., 2018). Vandagriff (2020) posited that more clarification about RPT requirements regarding types of publishing might make OA less mysterious and result in promoting greater educator and researcher involvement.

Another powerful way that institutional administrators can promote the work being done by their scholars and promote Green OA publishing, is by encouraging the use of institutional repositories both as a place-to-store completed scholarly works online and as a place to seek out others' works. University policy could require all work counted toward tenure and promotion be shared in their institutional repositories (Roehrig et al., 2018). According to Roehrig et al. (2018) many institutions have mandates or suggestions on using repositories, however, these are not enforced and are often not followed. Unfortunately, authors are often plagued with apathy and fear when it comes to exploring publishing options outside of traditional avenues. Roehrig et al. (2018) provided data from interviewees being asked about OA repository participation, "It's not my job. I don't have time. I won't get rewarded. I don't want to rock the boat."

Higher education scholars can be encouraged by administration, faculty senates, and policy makers to consider the moral reasoning for OA publishing, in addition to the personal career benefits (Roehrig et al., 2018). To further promote the tenets of social justice, institutions can evaluate repositories for altruistic impact. This will align with the missions and visions of many and will also align with the Budapest Open Access Initiative Declaration (2002) (Heller & Gaede, 2016). One way this can be done is to examine whether the users of the content include researchers from LMICs. Heller and Gaede (2016) found that repositories of institutions in the American Midwest which emphasized social justice or similar goals in their mission statements all reported users from LMICs.

Institutions could also promote the use and production of OA by offering small grants to faculty and students that utilize and or produce OA resources. For those building curricula, they could be encouraged to utilize OA and Open Educational Resources (OER) as key components as opposed to high-cost textbooks. This would benefit students who struggle to finance textbook purchases and would promote the use and creation of open source materials.

Virtually all U.S. institutions have received Higher Education Emergency Relief Fund (HEERF) funds, and some institutions have already invested these COVID relief funds in OER programs in ways that support their efforts to leverage OER as a strategy to ensure all students have access to course materials. SPARC (2022) has published a new blog post highlighting how campuses in the US are using COVID relief funds for OER activities that reduce textbook costs, expand access to materials, and support remote learning, among other impactful ways to build long-term capacity for meeting basic student needs (Steen, 2022).

Institutional librarians are positioned to be highly involved in the move to encourage OA. Due to rising subscription costs for many publications, "the article paywall problem has increasingly come to affect even researchers at affluent institutions in the developed world" (Roehrig et al., 2018, p. 465) and since institutional libraries have finite budgets, creative ways to meet needs without additional costs are continually being sought. Librarians make choices about where to invest funds, which means high-cost subscriptions are not often started or maintained (Ola, 2018). Library funds freed up by the movement to OA can be invested in additional materials to help extend the disciplines that libraries can include in their collections. Their extensive work with subscriptions equips them with the expertise in copyright issues, such as those that feel mysterious to authors. This makes them a great point of contact for inquiries from scholars interested in publishing in OA. When it comes to university scholars trying to negotiate publishing contracts for OA, librarians may work in the role of liaisons between authors and publishers and leverage their understanding as well as their financial dealings with publication administrations (Roehrig et al., 2018).

Funders

Research funders also hold influence as to where and how recipients of their funding can publish findings. Funders are increasingly implementing mandates that recipients must disseminate their findings through OA. Examples of mandates that encourage and even require using OA have come from the National Institute of Health, the U.S. Department of Education, and the National Science Foundation, in the U.S. Whereas these policies, as well as those established in the United Kingdom and European Union policies are helping with OA engagement (Roehrig et al., 2018), even when mandates are established, researchers are not always following them because they are not generally enforced (Arunachalam, 2017). Those funders that already have mandates could implement ways to monitor and enforce their requirements (Roehrig et al., 2018), and other funders could be encouraged to establish and initiate similar policies. Funders and institutions could negotiate with publishers so that articles are posted in repositories when embargos end, without authors being responsible to do this on their own (Roehrig et al., 2018). Cutting out this step could increase the use of institutional repositories without additional work for the authors.

Publishers

Publishers are a unique set of stakeholders in this discussion. Commercial publishers, those trying to make a substantial profit, may not feel a moral obligation as do many non-commercial publishers such as university presses and scholarly societies. Commercial publishers have much to gain financially from restricting access to publications unless subscription fees or APCs have been paid. With OA publishing there may not be subscription fees to contend with, however the APCs may be exorbitant and therefore challenging or even out of reach for authors from LMICs to fund. In essence, the restrictions of access

may be lifting, but the restrictions on engagement in scholarly communication through publishing still tend to be more exclusionary to the scholars from LMIC.

When a publication is only available through a paid subscription, it limits who can consume or use that resource and when a publication requires a fee to be published, it limits who can share and promote their research. Either way, the traditional publishing model and the Gold OA publishing model maintain disparities as to who can participate in scholarly communication when these financial barriers are in place. Several publishers associated with large organizations, such as those working with American Education Research Association (AERA) make journals available to members through membership fees. However, this still limits access to those that can afford annual membership.

Many of the changes that would need to occur from the publishing standpoint may not come from within the publishing community, but rather may come from outside of it through the changes in mindset toward OA, the changes in policies about publishing, and the general movement toward opening of scholarly literature. Many argue that traditional publishing is run by academic elites at the exclusion of scholars that find themselves on the periphery of the academic landscape and that academia cannot claim to be a meritocracy given this method of sharing knowledge (Demeter, 2020). Others posit that traditional publishing hurts the advancement of research, and proponents of OA argue that publishing needs to move from the for-profit paradigm to one that shares openly for the good of society (Buranyi, 2017; Chattopadhyay et al., 2017). As was discussed earlier, there could also be a move to publish by different means while still maintaining quality, by using "libraries as publishers" (Raju et al., 2020).

OA as an Equalizer and Enhancer in Higher Education

"Education...beyond all other devices of human origin, is a great equalizer of conditions of men --the balance wheel of the social machinery...It does better than to disarm the poor of their hostility toward the rich; it prevents being poor." — Horace Mann

The Internet has changed how written scholarly communication is published and disseminated. Therefore, most peer-reviewed literature is housed electronically and can be accessed through the Internet from anywhere in the world. Most academics no longer search through stacks in libraries to find articles, but rather use Google Scholar or digital academic libraries. Unfortunately, even though a large portion of peer-reviewed or scholarly literature is online, it is still not open and readable, but rather requires one to be affiliated with a subscribing institution or requires a fee to obtain full access.

Given the changes in information science and knowledge management, what would Horace Mann say about opening access to scholarly communication? Would he argue that access to scholarly information is part of equitable access to education, especially in tertiary endeavors? Would he say that OA is a 'great equalizer' for academics around the world? In this chapter the proponents of OA are highlighted to show that it could be an achievable equalizer to support teaching and scaffolding of research practice in most if not all disciplines of higher education.

Enhancing Global Equity

The rapid expansion of higher education in developing countries, such as those found in sub-Saharan Africa, has come with innumerable challenges. New and young institutions face obstacles creating in-

frastructure and building human capacity. Many are working hard to expand without the benefit of full access to available research outputs. For training the next generation of researchers, the right tools are needed, and tools such as OA could significantly assist in these endeavors. By increasing free access to scholarly works, the argument could be made that this will enhance and expand the human capacity of institutions through the ability to expand the curricula, research activities, and research outputs of affiliated scholars.

Although OA will certainly not be a panacea for equity, if all researchers around the globe had unrestricted access to peer-reviewed research, the playing field would become more equitable. Many would argue that since much of the research conducted by academics is done so with public funding, there is a moral argument that the publications coming from such research should be open for public use (Pinfield et al., 2020). Making regional, national, and international research available could support researchers and educators around the globe, particularly in developing regions.

As was established early on in this chapter, OA is beneficial in all parts of the world. It may, however, be most advantageous for researchers and educators in LMICs. Unfortunately, much of the research examining perspectives on OA are coming out of highly developed or high-income countries with few studies having been conducted examining the perspectives of individuals in LMICs. In one notable exception, Nobes and Harris (2019) examined the perspectives of 507 self-selected researchers from LMICs in Africa, Asia, and Latin America. Their findings indicate that, from the perspectives of these researchers, many still have trouble accessing the research they need to complete a thorough review of what has and has not been done in their areas of interest. Only 8.1 percent expressed that they were able to access all the research they felt they needed (Nobes & Harris, 2019).

They also found a lack of awareness and utilization of institutional repositories (Nobes & Harris, 2019). This may also be true of researchers in high income countries; however, this lack of awareness does not carry the same weight for individuals who have the ability to access a high volume of research through their online digital libraries. It is still not clear if being unable to get to the necessary studies is the true challenge for those in LMICs, or if lack of awareness about OA, repositories, etc, is the larger obstacle. More research is needed about awareness of available resources.

When it came to choosing a journal for publication, many participants in the Nobes and Harris (2019) study indicated that Impact Factor and the journal's reputation are still more important than making their research universally available through OA. Some disciplines also specifically recommended publications in specific journals in order to be considered for tenure and/or promotions (Wical & Kocken, 2017). As was discussed in the section on social justice and stakeholders, much can be done to change the views held about OA for all stakeholders including publishers of high ranking or top-tiered journals.

Equalizing/Enhancing Curricula Development

In a variety of disciplines, a big portion of tertiary education is centered around training students to dive directly into empirical studies using peer-reviewed literature with the goal of guiding and teaching students to conduct research of their own. Teaching these skills is challenging under ideal conditions but nearly impossible if access to necessary scholarly literature is limited or blocked. Educators and students need the ability to locate, read, and share example studies in their specific fields. Teaching research without access to high quality examples of research designs and methodologies is an avoidable handicap. Not only that, but if scholars are interested in a narrow field or an emerging field it could be next to impossible for the library funding to be used to order and supply items in all cases.

Even if the libraries are well stocked and OA is available, effective research may require a particular research study to ground or support a direction of research. That particular study could be locked behind a paywall. No amount of other research will be helpful if the one study needed is not available. One study or group of studies does not necessarily replace the exact one being sought. The more research that is made available through OA, the less these occurrences will be experienced by researchers, wherever those researchers are in the world.

Increasing Scholarly Outputs

As stated earlier in this chapter, institutions and funders have a great amount of influence on supporting or thwarting efforts to increase OA. If OA publishing is encouraged by funders and institutions, more researchers would be willing to pursue this avenue of publication. It is possible that publishing in OA could have the effect of encouraging more collaborative work such as interdisciplinary, international, and collaborative projects (Fleming et al., 2021), which in turn would increase research outputs. In some disciplines the circle of researchers producing publications may become more cohesive and less competitive if the mindsets are to engage one another through research as opposed to compete. This could directly and indirectly enhance the scholarly communication surrounding these areas of research.

Collaborations also have the potential to increase scholarly outputs from newer institutions and early career scholars. In particular, several researchers working together to make use of limited resources of time, money, and personnel, can share participation in large-scale, and possibly higher quality studies. By involving researchers from several institutions, it not only broadens who is working on the research and diversifies the perspectives, it also broadens the scope and expands the population being studied. Studies can be expanded from individual researchers or small teams to larger groups from a variety of settings. In cross-cultural research, this may assist researchers from developing countries or less well-known institutions to have their voices and experiences added to the conversations.

Group projects have additional benefits, such as a larger data set and more diverse data being collected in less time across different networks and geographical locations. Group projects also come with challenges, such as being consistent across sites with data collection, participants, and synthesizing the data. Challenges related to ethical reviews can also increase with researchers from different institutions and countries, however with the growth of collaborations, organizations such as SMART IRB are being created and utilized. If the goal of collaborative work is to produce OA research, the benefits could far outweigh the challenges. However, if collaborative work, particularly that involving researchers from LMIC, is not disseminated through OA channels, some of the researchers producing the manuscripts may not have access to the final product once they are published. Collaborative work published in OA allows for scientific reproducibility and all the other benefits of OA publishing.

Another area of increasing outputs would be to make datasets and code available through OA (Fleming et al., 2021). Opening access to datasets would allow for examining and replicating studies and could increase quality and confidence in results (Fleming et al., 2021). Open data expands who can establish and answer research questions by conducting data analysis, rather than the current situation which predominantly consists of researchers who have the finances to collect data and to fund projects. Open data could grant a voice to perspectives and viewpoints that might otherwise remain silent. For the researchers who share datasets, they could find increased visibility for their efforts and their data could be more useful and impactful. All of the challenging work in which they invested to create and make datasets usable may benefit the community at a greater magnitude (Fleming et al., 2021).

A diverse set of stakeholders (representing academia, industry, funding agencies, and scholarly publishers) jointly endorsed a concise and measurable set of principles commonly referred to as FAIR (findable, *accessible*, interoperable, and reusable) data principles and FATE (fairness, accountability, transparency, and ethics) principles. The FAIR Principles put specific emphasis on enhancing the ability of machines to automatically find and use the data, in addition to supporting its reuse by individuals (Wilkinson et al, 2016).

In addition to the products of research studies, creating Open Education Resources (OER) has the potential to greatly expand curricular options. OER has not been the focus of this chapter although warrants a great deal of attention and future studies. OER has the potential of expanding the options educators have when building curricula (Ford & Alemneh, 2020) and bringing together colleagues both within and between institutions. OER has the potential to close the gap between students with the financial means to purchase the most updated textbooks and support materials and those that have to use what they can beg or borrow (Valentsianos, 2020). Creating and using OER as texts and support material for curricula design, especially in the field of research education could reduce the time and finances used in searching for the perfect textbooks and resources. Ford and Alemneh (2021) highlighted the benefits of OER, and among other points, they noted that OER has the potential to be updated rapidly and adapted for use by instructors for the specific needs of students within their own context.

In sum, open access to peer-reviewed literature, data, code, and open educational resources has the potential to make designing research curricula and practicing research at the tertiary level much more equitable, no matter where an academic finds themselves located in the world. With increased OA, one can access the necessary text, documents, datasets, etc. to teach a variety of methodologies across unlimited disciplines and conduct high quality research.

FUTURE RESEARCH DIRECTIONS

As has been articulated throughout this chapter, authors are increasingly choosing OA dissemination which is in turn making access to scholarly literature more equitable. Future research could focus on dispelling the myths and finding solutions to challenges surrounding OA. Research could also be conducted that examines the benefits to individuals, institutions, and society in general as this will help to promote OA as a viable choice for publication, which would further increase engagement. Additional areas that research could investigate are OA resource consumers and producers, meaning, is OA dissemination reaching researchers, educators, and practitioners in LMICs and are their voices and participation being included in studies. Epistemic justice was only briefly mentioned in this chapter as one form of social justice; however, future research could also be conducted that would further examine OA publishing through this lens.

CONCLUSION

OA is a social justice issue affecting researchers around the globe. Often researchers find themselves unable to access the scholarly literature needed to build the best possible curriculum or to expand knowledge on a research topic. Researchers in both LMICs as well as high income countries are affected by

this phenomenon, however, those in LMICs are more likely to hit access roadblocks that they are unable to overcome and less likely to have alternative workarounds available to gain access.

COVID-19 interrupted global education, however it also highlighted the critical importance of adopting OA as a method to share scientific output openly and more quickly so as to resolve global issues, such as a pandemic. This increased openness to research outputs proved a good example with vaccines being produced quicker than was historically the case. Of course, there were challenges, but the benefits of OA can be felt at the personal, professional, and societal levels. In the current data-intensive eScience ecosystem, beyond improving access to scholarly and scientific research for all stakeholders, OA supports implementation of guiding principles, including the FAIR (findable, accessible, interoperable, and reusable) and FATE (fairness, accountability, transparency, and ethics) principles.

The growth in OA is helping to reestablish who can access scholarly outputs. OA is an equalizer that can be promoted and embraced as the paradigms around knowledge management and scholarly publishing continue to change. OA is not the only equalizer necessary to consider, as there are several other factors contributing to academic inequality globally, both those geopolitical and societal. However, if access to scholarly outputs were less limited, some of the other inequities might also experience relief.

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KEY TERMS AND DEFINITIONS

Article Processing Charge (APC): A publisher's fee paid by an author (or their lab or grant) that is used to support the process of publishing a journal article. The result is usually gold (immediate) open access to the research output.

Copyright: A legal right created by the law of a country that grants the creator of an original work exclusive rights for its use and distribution.

Copyright Transfer Agreement: A legal document containing provisions for the conveyance of full or partial copyright from the rights owner to another party.

Creative Commons (CC): A nonprofit organization that offers freely available copyright licenses that provide a legal framework for giving users the ability to freely view, download and distribute content. Creative Commons (CC) licenses are not an alternative to copyright and work alongside copyright to reserve certain rights for themselves and those to whom they grant permission. Authors might be required or advised by their funders to choose particular CC licenses, such as CC-BY, when publishing their research as Gold OA.

Embargo: Restriction of access to the content of a copy of a work for a defined period of time.

Epistemic Injustice: When individuals or groups experience prejudice as knowers. This is experienced through the inability to access knowledge through scholarly works and the inability to produce and disseminate new knowledge.

Gold OA: A publishing model in which the official publication of research article is freely and immediately available for all to read and licensed for reuse by others. Typically, gold open access publishing models require an article processing charge (APC) paid to the publisher to make the item freely available to read through the publisher website. The model of not charging APCs at all (with publication supported through some other means, like the model in which this book is published) is sometimes called *platinum OA* or *diamond OA*.

Green Open Access: A version of a journal article or other work of scholarship which is made available through open access in a location other than the official publication of record, such as an institutional repository, a subject or disciplinary repository, or the author's personal website or other web-accessible digital archive, that is compliant with the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH). Publishers usually stipulate the version of manuscript that can be self-archived and the length of embargo period following publication before the paper is made open access.

Institutional Repository: A repository affiliated with a specific institution. In addition to preprints and published works, most allow members of the institution's community to submit other forms of scholarship, such as presentations, working papers, reports, etc. (e.g., UNT's institutional repository: https://library.unt.edu/scholarly-works/).

Metadata: Data that describes other data. For items in open access repositories, this usually consists of a full bibliographic information that facilitate access and use (e.g., title, creators, abstract, keywords and similar information).

Open Access License: The license outlines what a person may do with a third-party copyright work. An example of an open license is a Creative Commons (CC) license, which combines 4 basic elements: the attribution, the derivatives, the commercial use, and the 'share-alike' principle.

Open Educational Resources (OER): Teaching, learning and research materials in any medium – digital or otherwise – that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions.

Post-Print: A manuscript draft after it has been peer reviewed, often with the publisher's design and page numbers.

Pre-Print: Preliminary version of an article that has not undergone peer review but that may be shared for comment.

Publishing Agreement: A legal contract between publisher and author(s) to publish written material by the author(s).

Self-Archiving: The process of depositing your research output to a repository along with bibliographic metadata.

Subject Repository (Also Known as Discipline Repository): A digital collection that archives and makes available works of scholarship in particular fields.

Chapter 8
Implementation of Protection of Personal Information Act No. 4 of 2013 of South Africa by Comparing Universities of Venda and Witwatersrand

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ABSTRACT

Protection of personal information and access to universities' records requires the establishment of a records management division to handle personal information. Yet little attention has been focused on the roles and responsibilities of records management professionals, who enable the management of personal information. The purpose of this chapter is to assess and compare the current state of the implementation of the Protection of Personal Information Act No 4 of 2013 in two South African universities, namely the University of Venda and the University of Witwatersrand. The chapter used a qualitative research approach. Secondary data were derived from a literature search and primary data from interviews. Despite the enactment of the act, privacy breaches continued to increase due to the ineffective records management division dedicated to the management of personal information. Universities are to strengthen their internal process on personal information to comply with the General Data Protection Regulations (GDPR).

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INTRODUCTION

Implementing the Protection of Personal of Information Act of 2013 is essential to implementing an effective records management program. Universities were assessed on the effectiveness of the records management division on the provision of access to personal information. An assessment conducted at universities found a lack of records management programs to provide efficient and effective delivery to minimize litigation risks, promote accountability and transparency, and ensure compliance with POPIA, and support informed decision making (Netshakhuma 2021). This chapter aims to address access to personal information by presenting an in-depth of the literature surrounding the topic. The study gap is that the universities lack an effective record management program to provide efficient and effective information delivery. The research question is how a lack of records management programs affects the provision of information in compliance with the Protection of Personal Information Act of 2013. The General Data Protection Regulation (GDPR) has implications for universities on processing personal information from other countries such as European countries. The assessment was achieved by comparing the level of implementation by the University of Venda (UNIVEN) and the University of Witwatersrand (WITS).

BACKGROUND

South African government enacted the Protection of Personal Information Act No. 4 of 2013 that restricts the disclosure of personal and confidential information. The Protection of Personal Information Act (POPIA) 2013 was promulgated in November 2013. The government enacted the Act to control the collection, use, and sharing of information to protect the privacy of individuals identified by the university system. The POPIA compels South Africa's public universities to establish proper processes and procedures for implementation (Netshakhuma, 2019a). POPIA ensured that private and personal information is protected and prevent inappropriate disclosure of information that could harm institution or infringe the privacy rights of individuals. The Act regulates the processing of personal information by public and private organizations in South Africa. It is expected that enactment of the POPIA will contribute to transparency, promotion of individual rights, improve compliance with POPIA by ensuring that organizations adhere to the requirement of the Act.

Legislation is a factors that guide access to records (Nengomasha & Nyanga, 2015). This means that institutions are to meet legal requirements to manage personal records and provide accurate, relevant, and complete information (Cheng, 2018). The legislation provides guidelines on how to access information held by the state. Such information includes personal social media (Netshakhuma, 2019d and 2019e). Managing personal records by universities protects their interest and stakeholders.

This study adopted multiple case study research and cases were compared. The case provides an opportunity to reflect upon the capacity of current records management programs from both universities. Multiple case studies were chosen because the researcher was able to assess the level of adoption of POPIA. The case study enabled the researcher to understand the readiness of UNIVEN and WITS on the implementation of POPIA. The study focused on these universities because in one way or another they contributed and participated in the national universities' POPIA consultative meeting on the development of the protection of personal information code of conduct of universities. The other reason for choosing only these universities is because WITS represents the previously advantaged universities

while UNIVEN represents the previously disadvantaged universities in South Africa. Both universities collect personal information through online applications, hard copy applications, claim processes, and tender processes. Both universities are required to comply with POPIA requirements. The study participants were selected using purposive sampling. The researcher relies on his own purpose of the study to ask participants. It appears that purposive sampling provided the richness and the depth of the cases as they were aware of the status of implementation of POPIA. Participants who have chosen to be part of the study hold positions of administrative officer, compliance officers, and records officer. Participants selected were also knowledgeable about POPIA, records management program. Participants provided relevant information regarding the administration of personal information. A total of 20 staff members were chosen to participate in the interviews. Ten were chosen from WITS while another ten were chosen from UNIVEN.

Universities generate public records that need to be managed in compliance with POPIA (Katuu and Ngoepe, 2015). The Constitution of the Republic of South Africa Act 108 of 1996 provides for the right to privacy. The inclusion of the right to privacy in the Constitution imposes an obligation on the parliament of the Republic of South Africa to enact the protection of personal information act. This statement is alluded to by Swartz & Da Veiga (2016) who indicated that the purpose of POPIA is to provide a constitutional right to privacy by protecting an individual's personal information when processed by a responsible party. The premise of the study is that democracy is dependent on the protection of rights, such as the right to privacy.

INSTITUTIONAL CONTEXT

UNIVEN is a previously disadvantaged university in South Africa based in Vhembe district, Limpopo Province. The university was established in 1982. After the dawn of democracy in 1994, the university started recruiting staff from other countries. The transformation of the university started in 1994. It is through the intervention of the Department of Education which mandated the institution to transform into a comprehensive university that offers career-focused programs. UNIVEN is offering its programs and services in English. As of January 2015, there were appropriately 2000 academic staff and 11000 students. UNIVEN aspires to be at the center of tertiary education for rural and regional development in Southern Africa. UNIVEN, anchored on the pillars of excellence in teaching, learning, research, and community engagement, produces graduates imbued with knowledge, skills, and qualifications which are locally relevant and globally competitive.

WITS is a previously advantaged university in South Africa based in Johannesburg, Gauteng. According to Phiri and Tough (2018) WITS was established in 1922. The university was established in the South African School of Mines, which was formed in 1896 in Kimberley, in a mining town in the Northern Cape. As a college, it was transferred to Johannesburg in 1904. WITS also offered comprehensive education. The university was established to support the white privileged group even though its policy changed to admit black students. According to Osman and Hornsby (2016), WITS serves students of approximately 30 000 and an academic and support staff contingent of approximately 4000. According to Osman and Hornsby (2016) WITS has a history of research-driven institutions.

Access to Personal Information

Internationally, countries such as the United Kingdom (UK) made efforts to disseminate personal information for the benefit of societies. According to Shepherd (2017), researchers and policymakers want to use individual-level data produced by government bodies for a variety of public policy, education, and health improvement research projects. Shepherd (2017) further indicated that access to personal data by researchers under controlled conditions such as safe havens and security sites may be negotiated under national schemes such as the UK Administrative Data Research Network. Contrary to Shepherd (2017), the study conducted by Barata, Cain Routledge, and Wamukoya (2002) indicated that widespread culture of confidentiality is an obstacle to making provisions to personal information. Although POPIA establishes a statutory right to access university information, it does not in itself guarantee free and unlimited information access. Even when POPIA has been fully enacted, several operational requirements are required to make it usable and because the legislation was new, it was essential for the Department of Higher Education and Training to organize a workshop with all South Africa public universities. WITS and UNIVEN also sent delegates to the national POPIA consultative workshop.

WORKSHOP METHODOLOGY

The workshop methodology was developed to enable South African public universities to articulate their information needs of university communities. The workshop provides a mechanism to assist universities' compliance officers, records managers, ICT managers, researchers to manage expectations from the Information Regulator. The information regulator is responsible for oversight of personal information held by the public and the non-public sector. The workshop was necessary to all university stakeholders because protection of personal information is a sensitive issue and considerable act is needed to successfully manage expectations from different stakeholders. The workshop methodology provides a framework for university delegates to know the needs and constraints of access to the information within the provision of POPIA. An important part of a consultative workshop is for universities to implement the POPIA. When universities discussed further in their environment, it provided to develop systems to enable universities to champion records management in an effective manner. It is through effective records management programs wherein personal information can be managed effectively and properly.

POPIA Consultative meeting was designed as interactive events to identify user requirements for ensuring accountability and transparency. The workshop was achieved through presentations by a consultant hired by the Universities South Africa (USAF). Universities South Africa (USAF), formerly known as Higher Education South Africa (HESA), is an organization representing all twenty-six of South Africa's public universities. Public universities in South Africa include the Cape Peninsula University of Technology, Central University of Technology, Free State, Durban University of Technology, Mangosuthu University of Technology, Sol. Plaatjie University, Northwest University, Sefako Makgatho Health Science University, University of Stellenbosch, University of Johannesburg, Rhodes University, University of Cape Town, Nelson Mandela University, University of South Africa, University of the Western Cape, University of Pretoria, University of Witwatersrand, University of Free State, University of Limpopo, University of Venda, University of Zululand, Walter Sisulu University, Vaal University of Technology, the University of Fort Hare and the University of Mpumalanga. Each university was represented by two delegates.

The university POPIA National Consultative meeting was designed to stimulate demand by the public for information from the university through an open-ended discussion process. One of the pressing questions was the definition of personal data generated by universities. Most of the participants were willing to understand the type of personal data created by universities. Even though POPIA was enacted to deliberate on the protection of personal information. The Consultative meeting decides what level of information disclosure and which policy options are appropriate for universities. The University POPIA consultative meeting provides a framework for the discussion to take place.

The POPIA consultative meeting provide guidelines on universities to interpret personal and confidential material created by these universities. It seems that the Department of Higher Education and Training and USAF realized a need of enabling ordinary citizens to obtain access to information that every department has in its possession. It was assumed that if the department of Higher education and Training was willing, this could lead to a culture of information needed for accountability would be maintained and be relevant, The department of higher Education and Training was concerned that various universities were not ready yet to implement POPIA.

The consultative POPIA workshop was facilitated in a form of breakout groups with university delegates. Breakdown activities were done to understand the discussion issues on POPIA compliance. The discussions provided opportunities to draw out issues, such as the type of records required to satisfy accountability requirements within the organization or the means of accessing this information efficiently. The purpose of the POPIA consultative workshop was as follows:

- Discussion on the implications of the General Data Protection Regulation (GDPR) of the universities sector.
- Established a standard for the type of data that requires to be disseminated.
- Determining the type of information required for dissemination to various stakeholders
- Determination of providing access to research data with personal information.
- Ensuring that universities comply with the transparency requirement of the European Union
- A determination as to whether any information will be internationally transferred outside the European Union and the process to which that process will be handled.
- Determine areas of agreement and disagreement over access to certain personal information
- Prioritize information which requires to be automatically available to stakeholders
- Assess the capacity of existing and planned universities information systems to provide efficient access to personal information and ensure accountability, sustainability, and suitability to local needs
- It was an essential part of prioritizing for improving university service to its community
- Improve the dissemination of personal information that satisfies the university community
- Develop a code of conduct for all universities which will be standardized to ensure that records are managed appropriately.

The POPIA consultative workshop approach provided opportunities for the university delegates to understand all concepts of dealing with providing access to personal information. It also helped delegates to understand the concept of providing access to personal information. It seems that the POPIA consultative forum was a significant achievement in that it represents attempts to discuss the implications of personal information of the university public.

During the POPIA consultative workshop, delegates were asked to complete an attitude survey. The survey provided an opportunity for delegates to understand the concepts of personal information. There was a clear understanding that management of personal information is essential for a university. Almost more than 50% of delegates agreed that management of personal information is a challenge to some universities because of a piece of certain information that is of public interest which needs to be managed and disseminated.

Universities preserve records to promote community engagement (Netshakhuma, 2019d). In the case of both universities, there is reason to believe that the general public lacks awareness of the nature of personal information. It seems that the enactment of POPIA came to effect while universities never conducted awareness on the issue of protection of personal information. The interviews conducted at both UNIVEN and WITS confirmed that some of the participants were not aware of POPIA and its implication on the context of social, political, and economic development.

It seems universities lack processes and procedures to manage personal information. Both universities face challenges to control the privacy of information and promoting access. According to Nengomasha and Nyanga (2015), and access policy can go a long way towards eliminating several uncertainties such as interpretation of privacy and access to unprocessed materials.

UNIVERSITY RECORDS MANAGEMENT FORUM

The National consultative workshop was followed by the establishment of the South Africa universities Records Management Forum for Records Managers. The University Records Management forum is a subforum of the university consultative forum. The University Records Management Forum's mandate is to promote compliance with POPIA. It provides a starting point for the university to determine personal information needs to be available to demonstrate its accountability to the university community and therefore which information systems are most critical to allowing transparency. The University Records Management Forum took place at the University of Mpumalanga in December 2018. The University Records Management Forum partnered with the University of Mpumalanga to organize a forum conference where issues of managing personal information were discussed. The forum was an opportunity to raise awareness of the importance of records management programs. The forum ensured accountability and transparency in the management of university records. It also provides opportunities for universities to conduct gap analysis on readiness to comply with the POPI Act. The lack of preparation and loss involved creates the need for effective information distribution to raise awareness on the implementation of records.

IMPLEMENTATION OF POPIA

South African universities are in a process to develop procedures and processes to comply with the Act, but they are facing implementation challenges such as lack of functional records management division to deal with the provision of access to personal information, proper infrastructure, and lack of advocacy on the legislations (Botha, Globler, Hann and Eloff, 2017). This statement is alluded to by Shepherd (2017) who indicates that implementation of protection of Personal Information incurs costs to public authorities and requires systems, protocols, and specialist skills (Shepherd, 2017). POPIA requires personnel

to be skillful in the legal background, records, and archives management programs. The implementation of POPIA requires universities to establish a Records Management division, classification system and initiate a partnership.

Participants were asked about their level of records management training. The researcher found that although some of the staff had records management training at both universities, they were not conversant with legal requirements on the management of personal information. The lack of trained records managers on legal program matters affects operations or practices of providing access to various stakeholders. It is accepted that education and training play an essential role in updating knowledge and skills in records management

POPIA Code of Conduct

A POPIA code of conduct clarifies universities' values and principles, linking them with standards of professional conduct. Code of conduct can serve as a valuable reference, helping staff to handle personal information created and receive by an institution. There is a need to establish a code of conduct to protect personal information before the implementation of POPIA. A code of conduct for universities ensures the authoritative type of personal information is made available to different stakeholders. Code of conduct is a central guide and reference for university staff to disseminate and issue personal information. Universities capture, store and preserve information from various countries as a result of students or staff exchange programs. A code of conduct ensured that universities' research, teaching, and learning programs adhere to the requirement of General Data Protection Regulations (GDPR). The national code of conduct is useful to improve and benchmark record-keeping performance. The lack of a code of conduct to implement POPIA is a barrier to universities' implementation of POPIA. Most significantly, the establishment of an Information Regulator of South Africa and the appointment of the committee to deal with the information management of the university is the major milestone for the implementation of POPIA.

Universities Records Management Division

implementation of POPIA is dependent on the Records Management division establishment. In this case, both universities established a Records Management division. The University Records Management division mandate includes the provision of access to personal information. The responsibility of providing access and private information is assigned to a university registrar.

Records managers play a role in ensuring that personal information is accessible and usable over time and is contextualized through good metadata (Shepherd 2018, p. 268). Managing records to comply with the regulatory framework is part of the records management program to provide access to information (Phiri and Tough, 2018). This means that the protection of personal information and records management is inseparable. The regulatory framework that protects individual records is of little use if official records lack integrity. This implies that poorly managed records make it impossible to make provision of access to information. The regulatory framework is designated a single authority to oversee organization recordkeeping and assign to other authorities involved clear responsibility for their respective inputs (Luyombya and Sennabulya, 2012). This statement is supported by Abdulrauf and Fombad (2017) who indicated that a dedicated division should be put in place to oversight, implementation, and enforce-

ment of personal data legislation. Records managers and archivists have to manage records dealing with privacy, security, preservation, and intellectual property (Khumalo and Masuku, 2018).

The records management division plays a role to provide information to various stakeholders in an effective manner. This statement is alluded to by Shepherd (2017) who indicated that records managers provide access to records to internal business stakeholders to support the current activities of an institution. Khumalo and Baloyi (2017) posit that the right to access information affects records management disciplines since records management programs seek to make information available to citizens in circumstances that promote secretiveness and disregard accountability, transparency, and good governance. Transparency in dealing with confidential data is a priority so that individuals are aware of any circumstances at universities (Stankovic & Stancic, 2015)

Records management programs are supported by both universities. This is in line with the international trends as indicated by Dove (2018) that in terms of GDPR, organizations are to develop internal records keeping requirements and data protection officers are to be appointed. Records managers play an essential role to coordinate records management programs within universities.

Providing access to records is cited as a requirement for accountability, transparency, and good governance. According to Masango and Mfene (2017), transparency emphasizes public consultation and participation. Accountability and openness cannot be achieved within an established culture of indiscriminate confidentiality and secrecy (Barata, Cain, Routledge, and Wamukoya, 2002). Transparency must be fostered by providing the public with timely, accessible, and accurate information. Transparency and accountability by public affairs are open to scrutiny because it depends on the creation and capture of records through a systematic file plan. Institutions are to organize records to provide information to various stakeholders (Shepherd, 2017). The records systems maintained by universities are to be reliable and trusted by the public. Trust in organization and openness are enhanced by the responsive release of records under the Protection of Personal Information and proactive release by universities of open information about the conduct of public business.

implementation of protection of Personnel information requires universities to establish organizational structure. Within a university structure, more staff positions are to be created and allocated to implement a records management system. Through assessment, both universities lack the staff to handle all issues of personal information within universities. At UNIVEN, there is only a records manager and archivist responsible for records management. However, at WITS, the university employed three archivists to serve the entire university community. This personnel was responsible for the physical and electronic documents. At both universities, it seems there was a lack of skilled and knowledgeable personnel to provide personal information. For effective implementation of personal information, management requires universities to employ more staff. This implies that both universities are to employ records managers at various levels and categories to manage the implementation of personal information.

Classification System

The study conducted by Cheng (2018) indicates that record classification is a tool to prove access to information. Records Classification provides an opportunity for records managers and archivists to identify and categorize personal information to be disseminated to various stakeholders with consideration on matters of confidentiality and privacy. Records must be organized in logical structuring to predetermined categories that serve business requirements and represent a relationship between records, files, and series. Cheng (2018) further indicates that the effectiveness of any classification system depends on

its flexibility, integration of records schedules, and harmony with the practices of records management. A poor recordkeeping system limits access to public information (Shepherd, 2017). Classifying records with a trusted, trustworthy classification system enhances the dissemination of any information to the public (Shepherd, 2017). Similarly, Cheng (2018) alluded that Implementing a correct classification system would facilitate correct information dissemination. Only authorized persons have access to the information, thus preventing information from being stolen or damaged (Asogwa, 2012). The research found that organizations lack classification systems to classify personal records. Classification of information is necessary for organizations to distinguish between sensitive and non – sensitive data. There should be an assurance to stakeholders that personal information is preserved effectively.

Partnership

Implementation of records management programs requires partnerships with various stakeholders. This implies that universities build relations with internal and external stakeholders. Records managers need to partner with ICT system designers and data creators to ensure that data are managed and released appropriately (Shepherd, 2017). Establishing relationships is a key to implementing access to information (Bowker and Villamizar, 2017).

An amount of scientific research relies on access to and use of data collected according to Dove (2018). International scientific research collaboration is affected by the GDPR rules on transferring personal data from the European Union to a non-European Union such as developing countries (Dove, 2017). The process of transferring personal data is based on the following:

- An adequacy decision
- Appropriate safeguards,
- Specific derogations and
- Exceptions for one-off or infrequent transfers

The partnership of universities covers a geographic scope. Since the birth of democracy, there is a high trend for South African universities to build relations with European universities through students or staff exchange programs. The initiative is designed to strengthen the mobility of students and staff and foster the quality, inclusiveness, and competitiveness of higher education. Partnerships are based upon a co-envisioned long-term strategy focussed on sustainability, excellence, and values. The partnership offers student-centered curricula jointly delivered across inter-university campuses, where diverse student bodies can build their programs and experience mobility at all levels of study.

According to Dove (2018), data can be transferred to a country outside of the European Union or international organization without specific authorization. This provided a country has a relevant legal framework that has been assessed by the European Commission as having an adequate level of protection. This implies that universities' POPIA code of conduct is to be implemented based on the requirement of GDPR. Both universities (UNIVEN and WITS) are involved in data exchange with a limited number of students. There should be a mechanism to ensure that personal information is well protected by universities. The purpose of any exchange between European universities and South African universities is to be based on an increase of knowledge and exchange of information. It seems that the GDPR raises the standards of protection of personal information throughout the world. The GDPR obliges both UNIVEN

and WITS to strengthen their policies on accountability, transparency, safeguards, data subject rights, and research exemptions.

The Infrastructure of Handling Personal Information

Records management facilities are necessary to categorize records required to be accessible by various stakeholders. Formal instruments such as policies and standards are an essential part of a reliable records management infrastructure to provide access to personal information (Luyombya and Sennabulya, 2012). Facilities that provide access to personal information include policies on data management and records management. This statement is alluded to by Muchaonyerwa and Khayundi (2014) who indicate that records management policy is seen as a framework developed to manage records. Most of the records created by both universities are not cataloged which implies that they cannot be effectively accessible by various stakeholders as indicated by luyombya and Sennabulya (2012). There is a challenge to provide access to personal information from both universities as demonstrated by several volumes of hard copy records created by universities. Universities preserve records, however, are facing a challenge to provide access to information.

Personal records of a prominent person such as Nelson Mandela are required to be preserved in purpose build archives. Both university participants confirmed that storage space to keep personal records was a major concern. The majority of participants from both universities confirmed a lack of space to keep personal records. It was a challenge to store records on a database as such records would be lost. This raises a concern for both universities to develop strategies and procedures to manage personal records generated by digital information. This finding shows that records generated in digital format are vulnerable to various threats such as viruses, unauthorized access to an electronic environment, environmental security, and database security. The design of the building is to be in line with an archival design appropriate to protect personal information which could be used in the later stage.

According to Johnson and Grandson (2007), organizations must enforce automated security and privacy controls that conform to the principles to facilitate cross-border information. This implies that universities are to consider information security issues to provide access to personal records. Universities need to provide storage facilities to preserve. This statement is alluded to by Brown (2013, p. 120) who indicated that the storage area required to preserve personal records is to include the following characteristics.

- Sufficient storage space for the transfer of records from various units, departments, or divisions
- A backup regime to safeguard the data in the period between transfer and completion of ingesting in case of electronic records
- Controls to prevent unauthorized access to personal information.

Records, regardless of where they are stored, need to be trusted (Stuart and Bromage, 2010). The researcher found that both universities lack appropriate records storage to keep records.

Role of Information Communication Technology on Personal Information

Implementation of POPIA requires records managers to raise awareness of the role of ICT to preserve records. According to Shepherd (2017) advocacy is needed to ensure staff understands their constitutional

and democratic rights to access information. One area where universities were already working closely together is to improve service to the university community. Before both universities embark on advocacy, the organizational structure of the institution should be considered as an object for advocacy, as indicated by Hackman (2012). Advocacy on personal information needs to be directed to internal departments such as the human resources, finance, legal, communication, ICT, Office of the registrar, Communication, and Alumina. The study conducted by Asogwa (2012) emphasizes awareness of electronic records. Asogwa suggested the following to handle electronic records held within the information systems:

- Conduct a self–assessment on e-records management readiness to identify where they are, where they want to be; how they intend to go there, the facilities and resources that are available, and those that needed to be provided.
- Develop a road map to facilitate movement to that goal by identifying the typical risks associated with managing information resources in electronic records.
- Access all risks by benchmarking records and information management practices such as inefficient work practices, waste time, and slow–down decision making and implementation.
- Take time to appraise existing physical records and streamline the classification to meet global standard practices and advance plans to manage personal information.
- Develop, implement and maintain a codified set of records management policies and procedures and implement them regularly.
- Popularise the project by creating awareness among the staff, faculties, department, and the entire university community one - records management through organizing conferences, seminars, workshops, brainstorming, and other measures.

University employees confront technology barriers (such as software and format incompatibilities) to access or exchange information electronically. Incorporation of technology mandates in privacy laws could be an efficient way of realizing goals protection of information (Hilden, 2017). This statement is alluded to by Skatuu and Ngoepe (2015) who state that technological development impacted the creation and management of public records. Records managers are to raise awareness on electronic records management because most of the electronic systems hold personal information. This statement is alluded to by Asogwa (2012) indicates that initiative is to be done to manage personal information generated electronically because computers internet allows institutions to share information in complex databases. Abdulrauf and Fombad (2017) opine that data protection and technological development are interchangeable. According to Thurston (2015), most stakeholders are unaware that ICT systems store records, but ICT systems are needed for long-term preservation. Hence the electronic records must be preserved for the long term. The challenges with electronic records are that most electronic systems are not reliable leading to the loss of personal information. Electronic records with personal records may be stored on personal drives, unmanaged systems which may lead to a loss of personal information. This implies that information communication technologies increased the need for data protection. Processing of personal information manual posed the challenge of losing personal information. Hence databases containing personal financial and medical records may be extremely useful to individuals but without proper security protections that information may be accessed by others thereby threatening individual privacy. Abdulrauf and Fombad (2017) emphasized for institutions to improve their database facilities to raise questions on accountability and security safeguards of personal data in this database. This implies that an individual's data is an embodiment of personality which is under threat from the advances in

technology. Johnson and Grandison (2007) indicated that technology can address challenges faced by institutions by limiting access and disclosure of sensitive personal information stored in electronic records management systems. The privacy solutions must be economically and computationally efficient so that they can be incorporated into other systems. Asogwa (2012) indicated that most people inherit the right to privacy that can be violated, intentionally or by accident, in an electronic environment. Most of the personal information may be stolen by using a personal system which can threaten the use of personal information. Most of the organizations sell personal information for profit which has implications on the management of personal information of both universities. The implication is that both WITS and UNIVEN may be unprepared for electronic records management because technologies were known to be good at supporting the needs of personal information, minimizing the amount of personal information stored on these systems posed a challenge on the management of personal information. When the majority of participants were asked about the provision of access to information they indicated that they were not familiar with the provision of access to personal information of various universities. One measure of the success of the successful implementation of POPIA would be to conduct consultative workshops.

The study conducted by Netshakhuma (2019) found it a challenge to develop processes and procedures to manage university personal records generated in an electronic format. Both universities create and process access to personal information, and consequently greater volume of records was created. At both universities, it was found that records were frequently misplaced or lost due to misfiling. This showed the threat of a poor classification scheme (file plan) to document any records created. This posed a challenge to provide access to personal information. It seems that benchmarking was not conducted with various stakeholders to check whether information management is in line with objective institutions. The above findings correlate with those of Munge, Rotich, and Wamukoya (2014) which showed that the Kenya government has not formulated any tool used to benchmark Information Management practices across government ministries.

International Relations

Personal data protection is not just a South African requirement but is a legal business imperative in many jurisdictions (Baloy and Kotze, 2017). The implementation of POPIA requires universities to comply with international organizations' requirements such as the European Union. The establishment of POPIA has been influenced by the European Union Directive and Organisation for Co-operation and Development (OECD) guideline (Baloyi & Kotze, 2017). Most of POPIA data principles on accountability, processing limitations, purpose specification, further processing limitation, information quality, openness, security safeguards, and data specification participation are based on the OECD. According to Swartz & Da Veiga (2016), POPIA regulates the processing of personal information, in line with international standards and establishes conditions, according to prescriptions of minimum threshold requirements for the lawful processing of personal information. The privacy shield is an effort to enable protected data transfers to other countries (Colesky and Ghanavati, 2016). The GDPR regulates the processing of European Union citizens' data and personal data processed by entities established in the European Union (Dove, 2018). According to Erdos (2016), European Union data protection aims to create a common European space for processing personal data within the fundamental rights and freedom of natural personal rights to privacy. The GDPR aims to protect personal data in the digital world, which pays little regard to geographical boundaries (Dove, 2018, p. 1019). Globalization led to a distribution of information anywhere in the world. GDPR is important in its scope and its require-

ments for adequacy clauses. To ensure that European citizens would also be protected when embarking on university exchanges abroad, the GDPR covers all processing of personal data all processing of EU student data abroad. South African universities have implications on the GDPR have challenges on the management of the privacy of information within the universities. The GDPR is a European Union (EU) that was established to replace the Data Protection Act 1998. The Data Protection Principles requires organizations to adhere to the following principles:

- Processed lawfully, fairly, and transparently
- Only collected and used for particular lawful purposes
- Adequate, relevant, and not excessive for that purpose
- Accurate and up to date
- Stored no longer than necessary
- Information is to be kept secure, and its integrity and confidentiality are protected.

The GDPR was enacted to protect European Union citizens' data privacy and harmonize data privacy laws across. The GDPR provides a framework coherent with technological advances, globalization, and the development of the digital economy, the legal security demanded by individuals in the processing of their data (Martinez- Martinez, 2017). This statement is alluded to by Dove (2018) who indicated that ensuring a level of protection of European citizens and removing the obstacles to the flow of personal data within the European Union, the European Commission urged protection of the rights and freedoms of European citizens concerning the processing of personal data should be equivalent across European states, with a consistent and homogenous application of the rules for the protection of fundamental rights and freedoms. This implies that non- European Union members such as South Africa intend to embark on a student or staff exchange program is to align their policies and procedures European Union concerning the management of personal information. The GDPR has implications on the dissemination of research data to various stakeholders which has implications on records management. The GDPR affects South African universities such as WITS and UNIVEN because of internationalization which requires proper management of international student records of university programs. Both UNIVEN and WITS engaged in student or staff exchange programs which led to an exchange of information with various international universities based in the European countries. As a result, both universities process the personal information of various individuals.

Universities contribute knowledge production for global knowledge hence they build international relations to preserve institutional memory. The demands on the global economy and the value of free information flow are promoting countries to resolve legal differences regarding privacy and agree on elements of data protection (Johnson and Grandson, 2007). It is essential for universities to not only comply with South African personal data protection legislation but to provide protection in line with international laws or benchmarks.

FUTURE RESEARCH SUGGESTIONS

A study may be extended to other South African universities to assess the implementation of records management programs in compliance with POPIA.

CONCLUSION AND RECOMMENDATIONS

The study established that both universities were aware of the requirement of POPIA on the management of personal information and had taken several initiatives aimed to establish records management practices. However, both universities are faced with a lack of records management division, and infrastructure to sustain the POPIA program. The Records Management division is to be empowered to control and manage all records created by universities. Hence, there is a need to disseminate personal data. Individuals work with personal information in a different context. It appears that there was a lack of awareness about the dissemination of personal information by both universities. there is a lack of personal information policies from both universities, which compliments personal information.

The finding brought questions about the readiness of UNIVEN and WITS to implement the POPIA act. Both universities develop a records management infrastructure to support the implementation of the objectives set out by the information regulator to ensure that information is accessible to all stakeholders.

Universities need to develop policies and establish records management programs. Both universities are required to raise awareness of government employees about the role and the implications of not managing personal information properly for decision-making.

This chapter has considered at each stage what the records manager's role should be in the legislative and government policy contexts. The policies and procedures need to be developed to ensure that organizations provide access to information. Developing effective records management system is essential to ensure effective dissemination of personal information without violating the privacy and confidentiality of individuals. The expertise of the records manager is crucial to the protection of personal and official data while ensuring the release of information into the public domain. However, there is a need for a records manager to collaborate with other professionals such as auditors, compliance officers to disseminate information to various stakeholders.

The implementation of POPIA requires universities to build relations with other institutions to adhere to GDPR. Both universities adopted an internationalization strategy. The strategy requires universities to embark on student and staff exchange programs with European countries and other institutions. The protection of personal information is a core component of building relations with other international universities. Internationalization increase the high level of human resource mobility across national borders and the creation of new knowledge through networks irrespective of boundaries

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KEY TERMS AND DEFINITIONS

General Data Protection Regulation (GDPR): It is a European Union regulation. A Person or entity in South Africa needs to comply with the GDPR's requirements if they process personal information of individuals based in the European Union.

Internationalisation: The Process of integrating an international, intercultural or global dimension into the purpose, functions or delivery of universities.

Personal Information: This is any information related to data element identified as human elements.

Protection of Personal Information Act No 4. 2013: It is the South African Legislation enacted by the South African legislature to protect people from harm by protecting their personal information.

Universities South Africa: This is an institution formerly known as Higher Education South Africa (HESA) representing all public South African universities.

Chapter 9
Open Access:
A New Ecosystem of Research Publications

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ABSTRACT

Academic research has traditionally been published under a subscription model with limited access and exposure. However, in recent years, open access (OA) has spawned a new research publishing economy. Journals have become more accessible in the research sector, with anybody able to see or access them for free on an internet platform. In certain research areas, the transition to openness has progressed more quickly than in others. Communication, education, and employment around the globe have become simpler as a result of the dynamic changes taking place online. Learning has become more equitable as a result of having access to information. Such uninhibited access has effectively opened the door to knowledge, educational resources, and a tremendous quantity of data. This material can be used for societal, educational, and scientific purposes. Given quick access, OA was a tremendously beneficial source for academics, scientists, and researchers during the COVID epidemic. This chapter covers issues related to open access, including OA ethics and OA strategies.

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INTRODUCTION

The Internet era revolutionized the world when it began in the late 20th century, pushing the world from Industrial revolution to Internet Revolution. Thus, mankind embarked on a journey in which the economy evolved to function and operate based on information technology. This Internet Revolution transformed the business and education world with the easy transfer and access of information. It facilitated high-speed communication and confluence of computers, electronic gadgets and wireless devices. With the arrival and development of the internet and different services of internet, Open Access was conceived. In 1991, the scholarly and research world saw the early footprints of open access with the initiation of the online subject repository arXiv, which provided to peer reviewed online journals in the early 1990s, and the opening of the National Institute of Health's repository Pub Med Central in 2000. More development took place in 2002 and 2003 when three separate conventions took place in Budapest, Berlin and Bethesda, resulting in an official and internationally acknowledged premise of "Open Access." The commonly established definition of open access literature is as such: Open access literature is digital, online free of charge and free of most copyright and licensing restrictions.

Open Access as a concept has gained momentum in the last decade. Researchers and academicians across the globe are adapting to this revolution in publication, creating a new scholarly communication, ecosystem. This revolution is benefitting researchers by allowing them to publish free of cost, as well as enabling all to access such work free of cost. This, then, is making their research efforts seen and referred all over the world, increasing citations, and giving opportunity to collaborate for enhanced research as well as recognition.

According to Peter Suber, an eminent researcher and one of the pioneers, OA is defined as "digital *research literature available online* without any charges and also liberated from most of the copyright and licensing constraints."

Open access is an array of principles and practices in which research materials are disseminated online, *with no cost* to access. A principle of OA is enabling dissemination through copying, but with proper attribution and protection of the content from modification. A publication is considered 'open access' when it is freely accessible and it is free from any kind of financial, legal or technical restrictions. Such kind of publication can be read, copied, distributed, downloaded, and printed within the legal agreements. Due to this digital technological and networked communication, the sharing of information has grown faster and created a new ecosystem to access or share information online. This also made to adapt to sharing of information through World Wide Web, for the easy and free access to information.

Open Access – Benefits to Researchers

Laakso and Polonioli found that little research on the relationship of open access and the humanities. Their research mapped the bibliometric status of open access to publications in journal by different ethicists. The study focused on direct publishing in open access as well as the type of online structure or platform in which the researchers share publicly their work. The outcome of the research reveals that most of the publications in journals are freely available to the public. Two of the most preferred platforms were Academia.edu and Research Gate. Institutional repositories were not found to be favoured as platforms to publish the research work by the researchers (Laakso & Polonioli, 2018).

Watson examined the benefits of open access publishing, concluding that it is a good platform for the authors to exhibit their research work free from any restriction and without infringing copyright

constraints. Open access benefits the researchers by increasing the visibility of their research work. However, there are instances of deceitful practices of some open access publishing, notably casual and lesser sincere work on the part of editors' work and peer review process. This has led to a perception of below average and mediocre research work (Watson, 2015).

Houghton and Sheehan identified the traditional models of publishing scholarly research and the advancement in ICT that has disrupted the conventional models of academic publication. The authors attempted to determine if the new ways and models for scholarly publication could bring about revolutionary transformations in the research and the publication world. They identified the drawbacks of subscription model pertaining to admittance and competence, and they examined the possible ramification of improved right to use study results by means of a tailored Solow-Swan model. The authors concluded that open access facilitates considerable gain to research and development process (Houghton & Sheehan, 2009).

Hajjem, et al. (2005) attempted to evaluate the influence of Open Access on the 'citation impact'. They examined the research publications and the frequency of citations to these works when they are available on open access. The researchers used the ISI CD-ROM database from 1992 – 2003 to study the different journals and the year of their publication. The researcher made comparison between every journal and the corresponding research objects which had not been made available on open access by their creators by self-archiving the articles on the internet sites. The results revealed that research articles which were accessible on open access had a significantly greater number of citations. The authors concluded that OA positively and positively impacts the citation counts for the journal articles. The researchers recommended that funding organizations, research and educational entities adopt the strategy of mandatory self-archiving which would inevitably increase the impact of research work in all fields.

Evolution of Open Access

Open access began with an international movement in early 2000's with the intention to increase access to research publications and educational knowledge with no costs or exclusions above that of access to the internet. The expression "Open Access" was first used during the Budapest Open Access Initiative in the year 2002. Afterwards, the Bethesda Statement on Open Access Publishing was released in 2003, and the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities in October 2003.The Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities (2003) formulated the principles of open access. Many international academic and research organisations have signed the declaration.

Amplified visuality and repeated utilization of publication and research works are considered to be the most striking features and benefits of the open access model. However, some researchers do criticize open access activities on the grounds of poor quality of work and duplication of publication outputs. Several universities and research institutions have adopted whole-heartedly open access as an innovative publishing structure and have been instrumental in making OA as a novel ecosystem of research publications. This unique research ecosystem facilitates unhindered erudite communications and research information obtainable to all the stakeholders devoid of any fees or charges.

STAKEHOLDERS

Researchers

It is now an acceptable fact that researchers benefit immensely form open access as on average, open access articles receive more citations than paywalled articles. Researchers also benefit from the fact that when they publish their research articles on open access cohorts their research study achieves higher Altmetric scores than those of closed access platforms.

Researchers can influence their societies through their research. Open access helps researchers' work reach new researchers, scholars, readers from a survey conducted by Coonin in 2011, 62.6% of business faculty believed that open access reduced the cost of overall journal subscription costs to libraries and thus few business faculty members find open access to be more economical. Also, the survey reported that there were other motives of business faculty, of 76.1% who self-archived their manuscript as it could be widely available in open access, while 38.7% of business faculty felt the readership of their article would increase in OA.

Other researchers are usually the target audience for research publications. Researchers benefit from open access as readers since it allows them to access articles that their libraries would otherwise have to pay to subscribe to. Users in underdeveloped countries may be one of the biggest benefactors of open access, as some colleges are now unable to redirect funds to the subscriptions required to read the most recent publications. There are certain programmes that provide low-cost or no-cost subscriptions to scientists linked with developing-country institutions. Because no library can afford to subscribe to every scientific journal, and most can only pay a small fraction of them, all scholars benefit from open access.

Copyright

Open access expands the reach of research beyond the confines of academia. Anyone — an expert in the field, a researcher in another field, a journalist, a politician or public servant, or an inquisitive layperson – can read an open access paper.

Open Access (OA) refers to everyone having free access to information and limitless usage of electronic resources. Open access can refer to any digital content, including music, texts, video, data, software, and multimedia. Some of it consists solely of text, while others contain data, executable codes, and graphics. Non-scholarly content, such as movies, novels, and music, can also be used in this way. For the sake of innovation, scientific discovery, and socio-economic growth, OA benefits researchers, scholars, instructors, the general public, and media professionals. OA could be used for dissemination of content, for example,

- The copyright owner or author irrevocably provides to all users the right to use or read the content for an endless amount of time, use, copy, and distribute the content with due acknowledgment.
- It is submitted / deposited in electronic form, instantly and in its whole, in a widely and internationally known open access repository.

Libraries

Libraries are one the primary stakeholders of open access as they are responsible for creating, preserving and disseminating knowledge. With the advent of open access their processes and practices have undergone significant changes. As the global research ecosystem has been using open access, libraries too have embraced the new open access model as they are at the epicentre of the entire evolution process. Libraries are now bracing up for the issues and challenges that they require to handle with the new working environment and practice of open access (Ojennus, 2020)

Cryer and Collins have suggested that librarians play a significant role in transforming academic research works for example by "pointing a patron towards a policy, mentioning open access funding opportunities in passing, activating access to an open access journal or creating an informative Web guide." (Cryer & Collins, 2011)

Librarians' involvement is considered prime in all the phases, facets, practices and deliberations involving every category of open access be it Gold, Green or other forms. Academic and other research organizations libraries are responsible for managing the institutional repositories (IRs), generating awareness about the open access among the academicians, researchers, students; providing copyright trainings to researchers and informing about the funder policies. Libraries also facilitate access to the mounting number of OA resources and funding OA.

Society

UNESCO, through its Open Access Publications Portal, makes knowledge for social development available to the public and assumes responsibility for sharing all of its successes and results. Many resources, such as journals, video presentations, books, data, and periodicals, as well as other types of knowledge, are made available for free in areas such as the environment, gender, arts, literacy, and other concerns in development. The majority of the resources are licensed under the CC BY SA licence, although others are available under the terms, which are explicitly noted.

Creative Commons (CC) is a model agreement that allows anyone in the world to freely share, download, modify, re-use, copy, translate, and build on it. Additional licensing terms include Attribution-Share Alike, Attribution-Non-Commercial Share Alike, Attribution-No Derivatives, and Attribution-Non-Commercial-No Derivatives for some publications.

UNESCO also endorses OA as a means of putting a scientific focus on publicly financed research. It has institutes and centres, as well as a global network of field offices, partnering for the adoption of OA-enabling policies in order to raise and improve understanding of the benefits of OA.

The Norwegian, Colombian, and Danish governments, as well as the US Department of State, are all sponsors of the Global Open Access Portal (GOAP). The Global Open Access Portal (GOAP) is financed by the Governments of Colombia, Denmark, Norway, and the United States Department of States. This platform offers an existing position of Open Access to scientific research and wide range of information in 158 nations globally. The portal presents an advanced analysis of the Open Access environment to policy-makers, advocates and delegates from national, regional and Non-Governmental Organizations (NGOs) as well as members of the Open Access community. It does not give any kind of record of repositories, Open Access journals, and other related programmes. The basic aim of the portal is to become the primary hub for any kind of open access information. The portal acts as knowledge

portal supplying information on required structure surrounding Open Access funding, advocacy and support organizations throughout the world.

TYPES OF OPEN ACCESS

There are different types of open access resources which are universally denoted by a colour scheme. The most commonly used names are "green", "gold", and "hybrid" open access; however, there are other systems and alternative terms also used. Gold Open Access – Gold Open Access is online publication of an article in a journal by an author without pay wall or subscription fee. All content and articles of a journal is allowed to access on internet to anyone in the world. Gold OA allows manuscripts to be permanently and freely available after copyright restrictions are removed post-publication (Springer, 2020). There are two options of publishing in Gold OA:

1. Publishing in Fully Open Access Journals, or
2. Hybrid Open Access

Green Open Access refers to articles published in traditional pay walled or subscription-based journal, but allows for authors to self-archive a version in specialist online repository (archive) or freely accessible institutional archives (website). This allows author to keep the non-commercial rights to their respective article so it can be posted in open internet archives. These archives could be institutional repositories or discipline specific maintained by scholarly association. Green OA provides authors on deposition of manuscripts flexibility. Green OP is a kind of hybrid OA that permits authors to self-archive manuscripts, allows to access manuscripts freely. Authors may self-archive:

1. The submitted version after acceptance or
2. Accepted version by 12 months to 24 months

Hybrid Open Access allows selected articles or content available at free of cost while others are accessed through subscription fee. Springer, BioMed Central, Elsevier and Wiley-Blackwell, the most well-known journals have offered hybrid Open Access as a middle-ground approach.
Yellow OA is the right an author has to preprint (before the general publication of the work)

Ethics

Open access publishing offers several benefits to the researchers. Researchers get the opportunity to exhibit their research free of cost without the fear of infringement. This encourages more views and accessibility to the general public and the citation also increases for the research work. Universities and funding authorities and agencies have acknowledged this advantage and therefore are promoting open access publication.

Willinsky and Alperin (2011) examined the different ethical principles by which research literature is distributed. The authors concluded that the ethics in research is related to basic right of mankind to gain knowledge. They further state that accessibility to research literature is hurdled by the monetary interest of the publishers and difference in author publishing charges (APCs) quoted for making the research

work accessible. Open access leads to quality research as it opens the free accessibility and leads to new and further research efforts (Willinsky, & Alperin, 2011).

Many researchers support and advocate open access publishing but not much has been said about ethics in open access. Parker studied the open access publishing and its effect on bioethics research. Parker found that most of the funding agencies were, at that time, making open access publication mandatory in the field of biomedical science. Parker advocated greater open access publishing because this enables rich discussion and reflection from public as it is freely accessible (Parker, 2013; 14: 16.).

According to a study undertaken by Mikael and et al.(Mikael Laakso, Andrea Polonioli, 2018), a significant amount of research work is on open access and is free to be accessed and read by the public. Phil Papers and academic social networks (Academia.edu and Research Gate) were commonly used platforms for ethic research works to be made publicly free. However, there is an issue of copyright infringement and under-sharing the research work. Many researchers are of the opinion that (Parker, 2013; 14: 16.), there are chances of exploitation when the publishing is done in subscription-based publication. It is considered quite unjust and manipulative when the authors and editors have to pay to view their own publication. Open-access publishing provides a free and independent platform for the researchers which is devoid of the monopolistic publishers whose publishing polices and process are very strict and rigid. Open access model facilitates creative and more dynamic research and publishing practices and lead to ethical research environment collaborations.

There have been reports of deceptive practices in open access publishing. Sometimes there is the lack of transparency and integrity in the publishing process. Even editors have been seen to have relied on unethical practice of favouring or rejecting some research work due to the publication authority and influence.

The ethical practice in any scholarly publication model including open access should be such that the final decision about acceptance of the research work should not be revealed to the editors. The peer –review should be truly blind and should accept the genuine and original research works based on merit only and not on any kind of recommendation.

Open access aim is to publish without taking any charges for publishing and the research work is freely accessible to one and all. This demands a high level of integrity and transparent reviewing and editing process and practice. Publishing house and editors who deal and operate in OA publishing are compelled to give complete as well transparent information and reveal all the open access processes. Usually, the Publication Ethics Committee has minimum direction and directives particular to editing procedures for open access. However, pertinent protocol and decorum for publishers related to lucidity and ethical practices are given by them. Quite similar matter is also observed in their policy for editors' position and work where it is suggested that editors are obliged to prohibit merging business needs with individual publication aspirations and avoid compromising in any manner in the intellectual and moral principles of the publication.

OPEN ACCESS STRATEGIES

OA research to a great extent emphasizes three main benefits (Burns, 2014): the advantages to libraries by way of access to journals and leading to cost-saving, the advantage to the community and to intellectuals by means of enlarged access, and the pursuance of open access by means of citation counts or number of downloads. Largely, there exists an extensive conformity that open access boost the citation

of any research study in a controlled circumstances as stated by Harnad & Brody (2004) Knowledge domain is considered as the vital aspect in deciding the result for any published research works. For example, Hajjem et al conducted a longitudinal study conducted by Hajjem et al. (2006) established that OA published research works have 36% to 172% chances to be cited than their non-OA counterparts across a wide assortment of knowledge spheres. Likewise, Antelman (2004) also demonstrated that citation rates for open access publications surpass those for non-open access publications by 91%, 51%, 86%, and 45% in mathematics, electrical engineering, political science, and philosophy, respectively.

Library and community leveraging OA have more gains towards higher access for libraries and readers. Thus, it is believed that the OA gains for public and library are much more than the expenses involved in the process. Drott (2006), for instance, demonstrates that "the emergence of the discussion of open access as a viable alternative to traditional publishing rests on developments in three main areas: economics, technology, and social justice" (p. 81). Hence, while OA's influence on the budget of libraries' is frequently discussed and debated whereas the OA's influence on the use of the library's collection is ignore. Institutional repositories can be categorized into four distinct types: governmental, aggregating, disciplinary, and institutional. Universities these days use different software tools to create institutional repositories.

Governmental OA Strategies

Earlier in most of the countries central government did not get involved in open access practices. There are still many countries where their governments did not yet bring in any kind of policy or regulation with respect to open access. It is the academics and research bodies that have dealt with the concept of open access. Agencies that fund the research literatures are in the job of setting the legislation and strategies for the open access research. These funding authorities create the guidelines for copyright, licensing and peer-reviewed publications for open access. It was the US government that was the first in the world to establish and approve open access legislation for the nation.

However, now governments in many nations are gradually acknowledging the advantages of good and effective national OA strategies. Many European countries are promoting dissemination of information and publication work, the creation of repositories and participation of researchers and scholar in the distribution actions.

In many nations, the governments have given importance to Open Access and have instituted national archives and national portals for accessing open access data, information, and research literature. Many policymakers have enacted and implemented copyright regulations that may apply to peer-reviewed publications. For example, the United States has created the Consolidated Appropriations Act, 2008 to provide guidelines for OA publications of the National Institutes of Health (NIH). The Act declares that The Director of the National Institutes of Health would make it scholarly publication model public all research funded by the NIH and submitted to the National Library of Medicine's Pub Med Central.

There has been a significant action taken in European nations for making open access strategies and policies more popular and synergised. Open Access Pilot was initiated across the European nations by the European Commission incorporating it in the Seventh Framework Programme in August 2008. European Commission directed the FP7 projects to submit peer-reviewed research manuscripts or ultimate project documents into an online repository. Another scheme was launched for the European countries named Digital Repository Infrastructure Vision for European Research (DRIVER), which was instituted to create a unified association of repositories for research literature and educational resources and materials. There

was a corresponding project named Open Access Infrastructure for Research in Europe (OpenAIRE)was also started which offered organisational and technological infrastructure for the detection, authentication, access and supervising publications funded by FP7 and European Research Council (ERC).

Institutions OA Strategies

Educational and Research institutions should design new policies and guidelines promoting open access practices and build adequate in-house support to facilitate depositing research work in institutional repositories. Libraries in the universities should take up the responsibility of creating common repositories and support the researchers and authors to upload their research literature. Institutions should have strong and well-defined structures and procedures to support and encourage large-scale content deposition centrally in the institutions.

Research work should be made freely accessible to research community by means of open access repositories. Open access services enhance more research work in the university and benefits he students and the faculty members. In fact, the entire society benefits from the open access repositories that make the latest research done in the field of science, social and humanities, medicine, and public policies open and available to all, thus distributing and transferring useful knowledge and information to all the people.

Several universities have created special funds for OA activities. Many publishers give discounts in the publication fees (APCs) to those researchers whose universities or organizations subscribe to some specific hybrid-OA journal. Discounts are also made available to general public and others who have purchased institutional memberships. In many universities and institutions, it has been made mandatory to provide open access to scholarly publications. Many institutions have set in place OA strategies for peer-reviewed scholarly publications.

Funding Bodies' OA Policies

There are several funding organizations that have made it mandatory for research works funded by them to be made open access. The organizations extend their support and assistance to the researchers, and authors conform to the policies and directives through the use of Gold open access publication course or Green open access registration. Many funding authorities have the provision of including the fees for open access publishing or even the APCs - article publishing charges in the research scholarship. Open access is done through publication in fully Gold open access journals or sometimes through choice programs. Choice programs are designed for subscription-based journals where the research work is instantly made accessible on open access when the APC is paid.

Several funding bodies oblige the researchers who choose Gold open access publication to select a Creative Commons Attribution (CC BY) licence which are in sync with their OA policies. Many funders offer a number of options of Creative Commons licences to scholars who decide to make public their research results in Gold open access publication. Many funding agencies make it compulsory for the authors who intend to publish their research literature instantly in Green open access to meet the terms with the policies of the funding agencies by submitting their research in an institutional repository.

DISCUSSION

Much of the work done and published by researchers all over the world are funded and supported by government authorities and other civil bodies and educational entities like colleges and universities. Open access facilitates wider and easy openness and accessibility of research literature and publication outputs specifically focusing on publicly funded research. Open access enables availability and improved productivity of expenses and investments made on large and detailed research studies, as well as research and development activities undertaken by government, NGOs, civil authorities and education entities when further work is done on the research. There are significant prospective benefits when the research findings are on open access platforms and anyone or everyone can use the information and data from the published research, building future perspectives and unexplored dimensions to the already existing research areas and topics.

Universities, funders, and research organizations across the globe have begun to employ and implement OA policies to encourage their researchers to make their research and data freely available. Some OA strategies operate on the two major models – Green and the Gold model. There are many funders who give the researchers the choice to decide on any model. Funders provide complete information about the open access directives and policies. Many funders and agencies have included OA in their funding policies by creating central funds that will be used to pay for the APCs of their researchers and authors. They have also created membership programs that institutions can join to financially support their affiliated researchers. Many universities advocate OA by creating framework policies and repository software. The university have connected the OA activities of their faculty members to their internal assessments and performance appraisals.

CONCLUSION

Open Access, as an alternative to traditional scholarly publication, has become a way of life in research world. Due to revolution in technology and communication, Open access has enabled researchers, academicians to showcase their research at free of cost to readers, and free access to such research content is in turn returning to them greater recognition as opposed to traditional method, wherein readers had to pay or subscribe to scholarly information. As Open access articles undergo rigorous peer review, the relevance, quality, and validity of such papers or research publications are very high (Ex: Taylor & Francis, Elsevier, etc.), thus, are very reliable. Free access to reliable content that is published relatively quickly increases citations, invites global collaboration, encourages greater engagement, and increases global visibility of authors and their work; it is now a new but established ecosystem for research and publication. The model of open access has tremendous benefits to the different stakeholders of research ecosystem. It leads to the conservation, protection and distribution of academic and research publications through open access repositories. Open access promotes research collaboration across nations using promoting a new global research ecosystem. Research world has witnessed significant advancement globally with the rise in institutional repositories that to grant open access to resources. Open access institutional repositories provide a platform to display research works and get wider visibility. OA practices maintain the global standards with respect to peer review, production and publishing. OA influences the impact factors. Universities and institutional are gradually employing open access strategies. These strategies help in promoting and supporting open access publishing and transmission of research outputs. These

policies create clear cut directives for open access publishing, usually through the institutional repository. Universities and institutions have begun adopting software tools and application development for OA repositories. Universities need to fabricate strong and effective instruments, infrastructure, technology and systems to promote OA among their students, research scholars and faculty. A visible and congenial OA ecosystem and culture need to be developed by the universities and research institutions that will result in more compliance towards the OA policies and practices.

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KEY TERMS AND DEFINITIONS

Copyright: The word "copyright" (or "author's right") refers to the legal rights that artists hold over their literary and creative works. Books, music, paintings, sculpture, and films are all covered by copyright, as are computer programmes, databases, ads, maps, and technical drawings.

Ethics: The area of philosophy known as ethics, or moral philosophy, "involves systematising, defending, and endorsing conceptions of good and bad action.". Ethics, like aesthetics, is concerned with considerations of worth; together, these subjects make up the area of philosophy known as axiology. Good and evil, right and wrong, virtue and vice, justice and crime are all terms used in ethics to define ideas such as good and evil, right and wrong, virtue and vice, justice and crime.

European Research Council (ERC): The European Research Council (ERC) is a public organisation that funds scientific and technology research in the European Union (EU). The European Research Council (ERC) was established by the European Commission in 2007. It is made up of an independent Scientific Council, a governing body made up of eminent scholars, and an Executive Agency in charge of implementation. It is part of Horizon 2020, the EU's research and innovation framework project, which was preceded by the Seventh Research Framework Programme (FP7).

Gold Open Access: Gold open access has the benefit of making papers publicly available from the moment they are published, allowing them to be used straight away. Furthermore, the open content licences associated with gold open access give broad exploitation rights, and the rapid availability creates a degree of exposure that has a beneficial influence on how widely a publication is distributed and cited.

Green Open Access: Green open access does not provide the same legal framework for material licencing as traditional open access. As a result, (scientific) exploitation is only authorised within the boundaries of copyright law's legal limits. This implies that the author's contract must be carefully evaluated in order for an item to be re-used in a way that meets the author's expectations.

Hybrid Open Access: Hybrid open access is a publishing paradigm in which authors can make individual articles gold open access immediately after paying an article publication fee to subscription-based journals.

Open Access: Open access is a large multinational movement that aims to make academic material, such as articles and data, freely and openly available online. When there are no financial, legal, or technical barriers to accessing a publication, it is defined as "open access," which means that anyone can read, download, copy, distribute, print, search for and search within the information, or use it in education or in any other way that falls within the legal agreements.

Chapter 10
COVID-19 Analysis, Prediction, and Misconceptions:
A Computational Machine Learning Model as a New Paradigm in Scientific Research

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ABSTRACT

COVID-19 is an infectious disease of the newly discovered coronavirus (CoV). The importance and value of open access (OA) resources are critical in the context of the COVID-19 epidemic. OA aided in the development of a vaccine and informed public health actions necessary to stop the virus from spreading. Many publishers implicitly acknowledged that OA was vital to promote science in the fight against the disease. Accordingly, publishers have committed to OA publication and scholarly communication of disease-related scientific research. This chapter covers three issues based on the modeling of the CoV dataset. First, an exploratory data analysis is done to detect the hidden facts and the relevant information patterns about the affected, recovered, death cases caused by the CoV and the vaccination details. Second, a predictive model is developed using machine learning techniques to effectively predict the number of COVID-19 positive cases in India. In the last step, a hybrid computational model is developed to identify the misconceptions that are spread through social media networks.

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INTRODUCTION

Scholarly journals have been turned into online publications/journals with the advent of the internet, and have developed numerous beneficial capabilities such as online submission, searching, indexing and referring to many items beyond merely citation referencing for improved scholarly communication. The importance and value of Open Access are critical in the face of the COVID-19 epidemic. Open access to scientific information and open data aids in the development of a vaccine and informs public health actions necessary to stop the virus from spreading. Open access resources keep citizens informed and educated about the virus, ensuring that they follow public health recommendations and allowing for distance study.

The novel coronavirus (COVID-19) was widely replicated in China at the end of 2019, infecting a substantial proportion of people. The coronavirus is a family of viruses capable of causing a variety of diseases that are life threatening to humans, including common and more severe forms of cold. The signs and symptoms of the disease may occur within two to 14 days after exposure. This time referred to as the incubation period is the time after exposure and before symptoms. The general signs and symptoms include fever, cough, tiredness, breathing difficulty, sore throat, running nose, headache and chest pain (Sear, R. F. et al., 2020). Other less common signs also include rash, nausea, vomiting and diarrhea. Some people may only have a few symptoms and some may not have any symptoms at all. These cases are referred to as cases, symptomatic and asymptomatic respectively.

As per the World Health Organization (WHO), data have shown that the virus spreads from person to person (about 6 feet or 2 meters) among the people in close contact. The virus spreads through respiratory droplets when someone is coughing, sneezing or talking. Such droplets may be inhaled or landed in a nearby person's mouth or nose. It can also spread when a person touches a surface and touches his or her mouth, nose or eyes, but this is not a major way of spreading the virus as per WHO reports (Saba, T. et al., 2021). In the case of symptoms (symptomatic), a person with the virus is the most infectious – and this is the time that they are most likely to transmit the virus – according to the Center for Disease Control and Prevention (CDC) trusted Source. But even before they start showing symptoms (asymptomatic) of the disease itself, someone can spread it.

India had the world's second highest (after the US), with 29.3 million cases of COVID-19 infections documented, and the third largest number of COVID-19 deaths (after the US and Brazil) with 367.081 deaths as of 12th June 2021. A second wave started in March 2021 with shortage of vaccines, hospital beds, oxygen cylinders and others in the various sections of the country being significantly larger than that of the first one. India led the globe in new and active cases by the end of April. In a 24-hour period on 30th April 2021, the country was the first to record more than 400,000 new cases. Health experts feel that India has underreported its data owing to a number of circumstances.

This chapter aims to study over time cumulative data on confirmed cases, deaths and recovered cases, and to analyze the transmission of this virus across India in the first step. It is feasible to acquire insight into how each state performed in COVID-19 using this data. During what time period was the particular condition successful, so that other Indian states might learn from their processes during that time period. In the second step, a predictive model is developed using the machine learning techniques to effectively predict the number of COVID_19 positive cases in India. AutoRegressive Integrated Moving Average (ARIMA), Seasonal Auto Regressive Integrated Moving Average with eXogenous factors (SARIMAX), FBProphet, Logistic Regression, Linear Regression, Ridge Regression, Decision Trees, Random Forest and Neural Networks are used for the predictive analysis in this chapter. In the last step,

a hybrid computational model is developed to identify the misconceptions that are spread through social media networks through public's tweets. The efficacy of the Misconception Detection System is tested on Corona Pandemic Dataset extracted from Twitter posts. For categorizing the dataset into two classes, FST and a weighted TF-IDF Model are utilized, followed by a supervised classifier: one with COVID-19 virus misconceptions, and the other with genuine and authorized information.

BACKGROUND

The literature review is carried out based on the sub-topics addressed in this chapter.

Exploratory Data Analysis:

Exploratory Data Analysis (EDA) is a data analysis approach that enables the discovery of hidden information within a data collection. This technique is frequently used to derive inferences from data. COVID-19 data are publicly accessible via the standard dataset repository. These widely available datasets are used to derive conclusions (DSouza, J., & Velan, S. S. 2020). Data visualization helps to understand the impacts of the pandemic on the variables/labels in the dataset.

According to experts, the number of confirmed, recovered, and deadly COVID-19 cases in India is anticipated to increase (Mahdavi, M. et al., 2021). Predictions are made using correlation coefficients and Multiple Linear Regression, with autocorrelation and autoregression employed to enhance prediction accuracy. The investigation is based on occurrences in several Indian states and is presented in chronological sequence (Varshney, D., & Vishwakarma, D. K., 2021). After data preprocessing, prediction analysis is done using Random Forest, Linear Regression Model, Support Vector Machine (SVM), Decision Tree, Neural Networks, Random Forests and so on. The Susceptible-Infected-Removed (SIR) model (Tutsoy, O. et al., 2020) is commonly used to estimate COVID-19 casualties.

The predicting techniques are generally categorized into two types: mathematical theory and stochastic theory (data science / machine learning techniques). The study generally includes statistical, analytical, mathematical and medical parameters (symptomatic and asymptomatic). The parameters cover various reasons behind the cause of coronavirus disease amongst people. Asymptomatic parameters include people's details who didn't show any signs of the disease yet they had it and the symptomatic parameters include people's details with fever, cough, tiredness and difficulty in breathing (Shinde, G. R. et al., 2020).

For anticipation of the disease epidemiological trend and rate of COVID-19 in India, Linear Regression, Multilayer Perceptron and the Vector Auto - Regression models are used. The prediction model is based on the cases which are in primitive stages and the Spearman's correlation is used to find the similarity between the features present in the dataset (Sujath, R. et al., 2020). As the dataset considered is non-linear, and dependent on each other, Spearman's Rank coefficient has led to inaccurate forecasting of the spread of the disease.

Several technologies including Blockchain technology, Internet of Things, Artificial Intelligence, Machine Learning, 5G and Unmanned Aerial Vehicles are used to reduce the impact of corona virus disease outbreak by analyzing the datasets available (Chamola, V. et al., 2020).

COVID-19 Prediction Analysis

(Bharadwaj, S. et al., 2013) highlighted how recent developments using Machine Learning (ML) and Artificial Intelligence (AI) are used for COVID-19 analysis and prediction. (Shorten, C. et al., 2021) suggested a deep learning model for the analysis of COVID-19 outbreak. (Mahdavi, M. et al., 2021) discussed the COVID-19 crisis using IoT and ML algorithms. According to (Alsunaidi, S. J. et al., 2021), important multisource urban variables (including temperature, relative humidity, air quality, and influx rate) affect daily new confirmed cases during early pandemic transmission stages. Another recent research (ArunKumar, K. E. et al., 2021) shows how machine learning algorithms can estimate the amount of incoming COVID-19 cases. Researchers used four forecasting models to anticipate COVID-19's risk variables: Linear Regression, Least Absolute Shrinkage and Selection Operator, Support Vector Machine (SVM), and Exponential Smoothing (ES). Each model anticipates additional infections, deaths, and hospitalizations.

In (Mahdavi, M. et al., 2021) article, three SVM models are created and evaluated on three separate groups of people: invasive, non-invasive, and both. Non-invasive factors provide mortality estimates equivalent to intrusive features and the combined model. Also, the model outperformed the invasive model with fewer features based on SVM-RFE (Recursive Feature Elimination) and sparsity analysis, revealing predictive information content in terms of SPO2 (Oxygen Saturation) and cardiovascular diseases. Time-series analysis and machine learning algorithms are used (Li, L. et al., 2020) for analyzing infected cases and fatalities caused due to COVID-19.

To analyze multivariate time series evolution, a cluster-based method named Hierarchical clustering is used for the COVID-19 pandemic. Countries are divided into clusters on a daily basis, according to their cases and death numbers. Algorithmically, the total number of clusters and the membership of individual countries is determined. This analysis gives new insights into COVID-19 's spread across countries and through time (Rustam, F. et al., 2020). Hierarchic clustering seldom provides the best solution, as it involves a lot of arbitrary choices, does not work with missing data, works poorly with mixed data types, is doesn't work well on huge data sets, and is commonly misinterpreted with its main output, the dendrogram.

In the data set from different regions of China, obtained from the WHO, the K-means clustering based machine learning method is used. Within the original WHO data set the temperature area is included to demonstrate the effect of temperature on each region within three separate COVID-19 perspectives – suspected, verified, and death (Abd-Alrazaq, A. et al., 2020). It is observed that temperature is not the only factor for the spread of the corona disease. There are several other factors for the spreading if included as attributes for the data analysis, a better model of avoidance can be emerged.

Identification of CoV Misconceptions in Social Media Networks

People utilize social networking sites such as Twitter® to express themselves, report events, and provide a worldwide perspective. During the COVID-19 outbreak, users used Twitter® to share data visualizations from news outlets and government agencies, as well as their own. During the COVID-19 epidemic, few people were also bombarded with incorrect and misleading information. To study a framework that can automate methods of combating the COVID-19 epidemic in smart cities, Mohammed N. (Alenezi, M. N. & Alqenaei, Z. M., 2021) proposed viable models for detecting misinformation. The suggested models include Long Short-Term Memory (LSTM) networks, a subclass of Recurrent Neural Networks (RNN);

Multichannel Convolutional Neural Networks (MC-CNNs) and K-nearest Neighbours Networks (KNN). (Kowsari, K. et al., 2019) examined Machine Learning and Deep Learning approaches for the identification of misleading information. D. (Kokatnoor, S. A. & Krishnan, B., 2020) suggested a technique which utilizes Context Knowledge, Distance Metric, and Word Resemblance to select crucial evidence based on news item titles and content found on the top 10 Google search results relevant to the COVID-19 information spread. This study created a COVID fake news dataset for future research and assessment.

Automated extraction of social media and Natural Language Processing (NLP) discussion of COVID-19 is done based on topic modeling for detecting topics relevant to COVID-19 from public views. In addition, LSTM's Recurrent Neural Network is explored for characterizing COVID-19 emotions. Results illustrate the importance of using public views and relevant computational methods to consider and educate the decision-making process in connection with COVID-19 issues (James, N. & Menzies, M., 2020)

Machine learning is used to quantify COVID-19 contents of establishment of health guidance, especially vaccines amongst online opponents. User's posts on Facebook are analyzed for both anti vaccination and pro-vaccination communities. Snowball's approach is used for scraping user's posts which discuss either vaccines or policies about vaccination or an argument on pro and anti-vaccination for the COVID-19 disease. Latent Dirichlet Allocation algorithm is used for analyzing the appearance and involvement of topics on COVID-19 (Schaar, M. V. D. et al., 2021).

Situational information from social media data on COVID-19 is identified, analyzed and classified using Natural Language Processing techniques into seven types of situational information. They are cautions and advice, measures taken, donations, emotional support, seeking help, criticizing and rumor spreading. The dataset is manually labeled, and later SVM, Naïve Bayes and Random Forest algorithms are used for the classification (Hossain, T. et al., 2020). The limitations are that the social media data doesn't come with a label and manual labeling is very time consuming and is limited to one's domain expertise.

Latent Dirichlet Allocation (LDA) which is a topic modeling algorithm is used in the grouping of similar tweets which occur in the same user to user communication channel. Cosine Similarity is used for extracting the topmost ten tweets (Alvarez-Melis, D. & Saveski, M., 2016). The grouping done by considering hashtags caused duplication of the tweets and thus took a lengthier training time thereby reducing the performance of the model.

The important topics posted by the public in twitter are identified using the online LDA topic model. A total of twelve different topics are identified which are consolidated into four main categories: Virus Origin, Virus resources, Virus Impact Factor on the Public, Countries and the Economy and the last category is the identification of ways of mitigating the risk of infection (Siddiqui, M. K. et al., 2020). The regular online LDA uncorrelated topics could not be captured due to the topic's distribution in the tweets collected. The number of topics in the dataset are specified by the authors which is subjective and doesn't always highlight the true distribution of topics.

MAIN FOCUS OF THE CHAPTER

Statistics and data, such as health and geolocation, can be used to combat COVID-19 in a variety of ways, including mapping the outbreak's location, tracking COVID-19 deaths and recovered cases, tracking vaccination details and disease spread, evaluating the impact of governments' virus-containment

efforts, and providing targeted information in high-risk areas. There is a need for transparent and open communication among researchers. In procedures that develop answers to the grave health threat that is likely to cause substantial hardships to humanity, it is critical to utilize scientific advances and support ideals of openness and participation (Waltman, L. et al., 2021).

Therefore, scholarly scientific information, COVID-19 data, experimentation and analysis are essential components in the development of new theoretical information. It is critical to recognize that the creation of new theoretical information to address emergency risk management requires an open and an unconditional access to and sharing of scientific contents, technologies, and processes by the entire scientific community from both developed and developing countries. To find a cure for the ongoing crisis, access to verified and peer-reviewed data and journal papers is essential. Verified knowledge and sophisticated scientific study can also keep the public informed about the situation and assuage worries sparked by ignorance or misinformation.

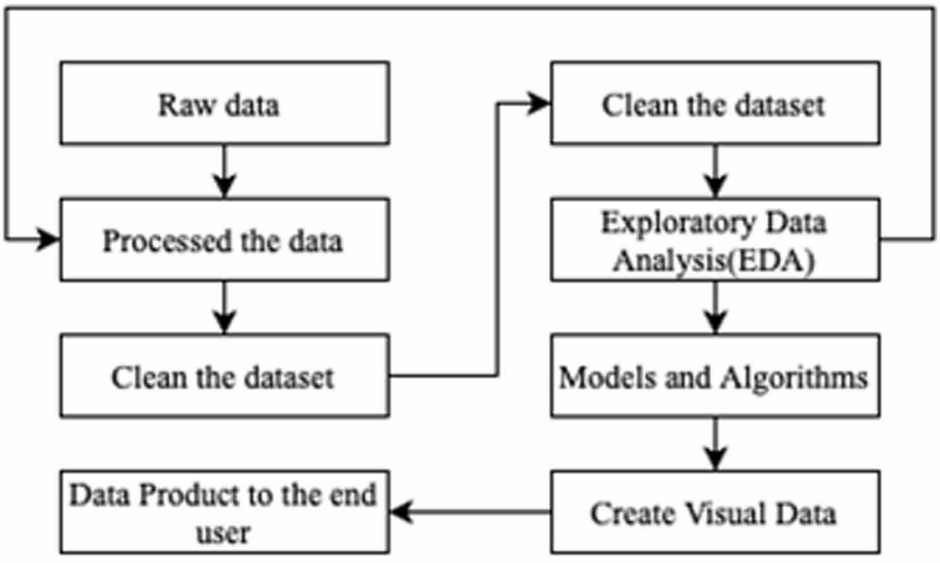
The chapter mainly focuses on three things:

1. Exploratory Data Analysis of CoV dataset
2. COVID-19 Prediction analysis
3. Identification of CoV misconceptions in social media networks.

Exploratory Data Analysis (EDA)

EDA is termed as numerical/graphical work which is required to be one in the initial stage of data processing and analysis. Converting the statistical data into graphical data makes the record readable and EDA is useful in this perspective. EDA is the first step that lays an accurate foundation to start the data analysis. Figure 1 gives the raw data processing in the data science field. To understand the number of distinct cases reported (confirmed, death, and recovered) in different Indian provinces, an EDA with visualizations is conducted.

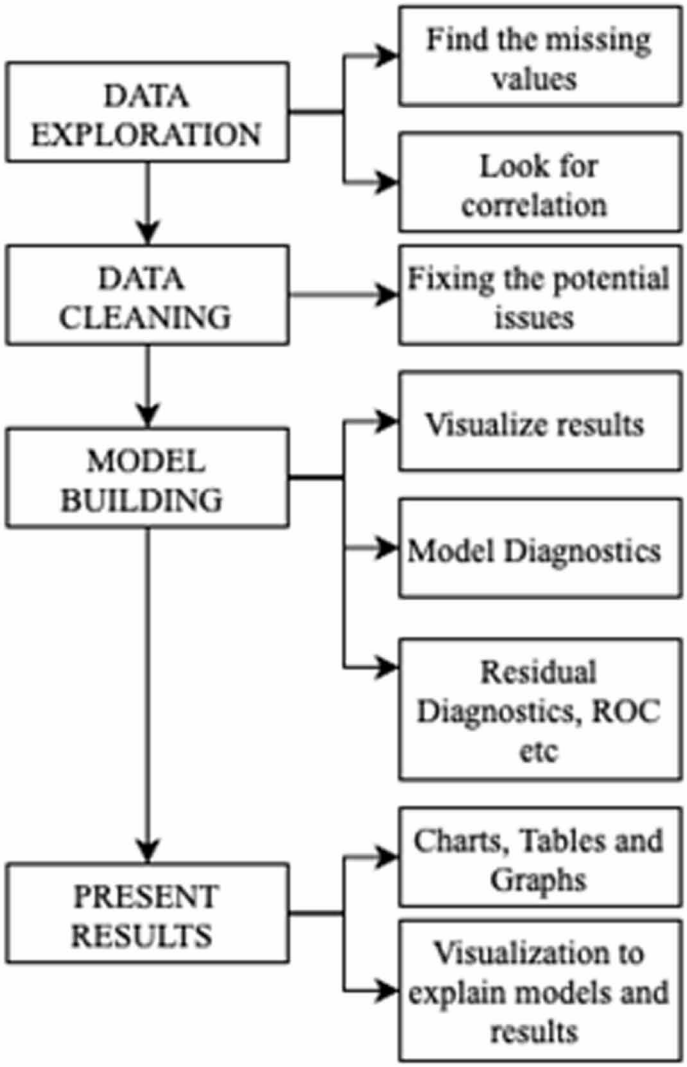
Figure 1. Process of raw data in data science



The process of EDA is shown in Figure 2, which briefs the steps and procedures present in EDA. The process of EDA begins with data exploration, which happens by finding out the missing values and looking for the correlation between the available values. The datasets having complete values helps in correlation of the data and this is achieved by cleaning and preprocessing it in the second step. The third step in the process is to visualize the dataset and run the model diagnostics and present the analyzed values. Finally with the help of models, visualized results analysis would be completed (DSouza, J., & Velan, S. S., 2020).
There are many stages for EDA and they are as follows:

- Description of the Information: Various types of information and different insights of the information are to be known before proceeding with the analysis. The description begins with the depict () function in Python. In Pandas, depict () is applied on a DataFrame which helps in creating error-free insights that sum up the focal inclination, scattering, and state of a dataset's circulation, excluding Not a Number (NaN) esteems. The lower percentile is considered a value of 25 and the upper percentile is considered as 75. The 50 percentile is equivalent to the middle.
- Dealing with Missing Information: Information in reality is infrequently spotless and homogeneous. Information can be absent during information extraction. Missing values should be taken care of cautiously on the grounds that they do not diminish the nature of the analysis being carried out. It can likewise prompt wrong expectation or order and can likewise cause a high inclination for some random model being utilized. There are a few alternatives for dealing with missing qualities. The following are few strategies adopted to address missing values:
    - Drop NULL or Missing Values: This is the quickest and simplest method to deal with missing values. This technique decreases the nature of the considered model as it lessens test size since it works by erasing any remaining perceptions where any of the values are absent.
    - Fill Missing Values: This is the most widely recognized technique for taking care of missing values. The missing values are replaced with a statistical measure like mean, median or mode of the specific attribute.
    - Predict Missing values with a ML Algorithm: This is done using outstanding and most proficient techniques for taking care of missing information. Contingent upon the class of information that is missing, one can either utilize a relapse or order model to predict missing information.

Figure 2. Processes in EDA



- Dealing with Anomalies: An anomaly is something which is independent or not the same as the group of data. Anomalies can be an aftereffect of an error during information assortment or it very well may be only a sign of fluctuation in the information. A portion of the strategies for recognizing and dealing with anomalies are as follows:
  - BoxPlot: It is a standardized method of depicting data distribution using a five-number summary: minimum value, first quartile (Q1), median, third quartile (Q3), and maximum value. It can reveal the values of outliers. It can also determine whether or not the data is symmetrical, how tightly the data is clustered, and whether or not the data is skewed.
  - Scatterplot: Dots are used to represent values for two different numeric variables in a scatter plot. The values for each data point are indicated by the position of each dot on the horizontal

and vertical axes. Scatter plots are used to see how variables relate to one another. The data points that are a long way from the populace are identified as outliers.

- Z-score: The Z-score is the marked number of standard deviations by which the worth of a perception or information point is over the mean worth of what is being noticed or estimated. While ascertaining the Z-score the focus of the information is rescaled and searched for information that are excessively far from nothing. These information focuses which are excessively far from zero are treated as the anomalies. In the vast majority of the cases an edge of 3 or - 3 is utilized. If the Z-score value is more noteworthy than or under 3 or - 3 individually, that information point will be distinguished as anomalies.
- IQR: The Inter Quartile Range (IQR) is a proportion of measurable scattering, being equivalent to the distinction somewhere in the range of 75^{th} and 25^{th} percentiles, or among upper and lower quartiles.

- Data Visualization: The approaches used to express data or information by encoding it as image representation using points, lines, or bars, are referred to as data visualization. Histograms, Bar graphs, Line charts, Pie charts, HeatMaps and so on are used for data visualization.

Relationship between Data Science and EDA

The principal motivation behind EDA is to help check information prior to making any presumptions. It can assist with recognizing clear errors, comprehend designs inside the information, identify anomalies and discover intriguing relations among the factors (Shorten, C. et al., 2021). Data scientists can utilize exploratory examination to guarantee the outcomes they produce for legitimacy and materialize it to any ideal business results and objectives. When EDA is completed and experiences are drawn, its provisions would then be able to be utilized for more refined information investigation or displaying, including AI.

Tools Required for EDA

- Python: Python is a high-level programming language with dynamic semantics that is interpreted and object-oriented. Its high-level built-in data structures, together with dynamic typing and dynamic binding, make it ideal for Rapid Application Development as well as use as a scripting or glue language to link together existing components. Python's basic, easy-to-learn syntax prioritizes readability, lowering software maintenance costs. Python facilitates program flexibility and code reuse by supporting modules and packages.
- R: An open-source programming language and free programming environment for measurable registering and designs upheld by the R Foundation for Statistical Computing. The R language is generally utilized among analysts in information science in creating factual perceptions and information investigation.

Types of EDA

There are basically four types of EDA that are summarized in Table 1.

Table 1. Types of EDA

Sl. No.	Type	Definition	Available Graph Form
1	Univariate non-graphical	This is the easiest type of information examination, where the information being examined comprises only one variable. Since it's a single variable, it doesn't understand the relationships with other variables in the dataset. The primary reason for univariate analysis is to portray the information and discover designs that exist inside it.	NA
2	Univariate graphical	It gives summary statistics for each field in the raw data set (or a single variable summary).	Stem-and-Leaf plots, which show all information points and the state of the appropriation. Histograms, a bar plot in which each bar addresses the recurrence (count) or extent of cases for a scope of values. Box plots, which graphically portray the five-number analysis: outline of least value, first quartile, middle, third quartile, and most extreme value.
3	Multivariate nongraphical	Multivariate data emerges from more than one variable. Multivariate non-graphical EDA strategies show the relationship between at least two attributes of the dataset through cross-classification or insights.	NA
4	Multivariate graphical	Multivariate information utilizes illustrations to show relationships between at least two attributes of information.	Scatter plot, which is utilized to plot information, focuses on an upward pivot to show the amount one variable is influenced by another. Multivariate chart, which is a graphical portrayal of the connections among factors and a reaction. Run chart, which is a line diagram of information plotted. Bubble chart, which is an information representation that shows numerous circles (rises) in a two-dimensional plot. Heat Map, which is a graphical portrayal of information where data points are portrayed by shading.

EDA Graphical Representation of COVID-19 in INDIA

For this study, three datasets are extracted from Kaggle.com. Table 2, Table 3 and Table 4 shows the retrieved dataset and its associated data files, along with their attribute descriptions.

Table 2. Description of attributes in CoV dataset

Sl. No.	Attribute	Description
1.	Date	Date of the observation in DD-MM-YYYY format
2.	Time	Time of the observation in HH:MM format
3.	State / Union Territory	India State or Union Territory
4.	Confirmed	Number of confirmed cases
5.	Cured	Number of cured cases
6.	Deaths	Number of death cases
7.	Latitude	Latitude value
8.	Longitude	Longitude value

Table 3. Description of attributes in statewise testing details dataset

Sl. No.	Attribute	Description
1.	Date	Date of the observation in DD-MM-YYYY format
2.	State / Union Territory	India State or Union Territory
3.	Total Samples	Total number of CoV samples collected
4.	Negative	Total number of negative samples
5.	Positive	Total number of positive samples

Table 4. Description of statewise vaccination details

Sl. No.	Attribute	Description
1.	Date	Date of the observation in DD-MM-YYYY format
2.	State / Union Territory	India State or Union Territory
3.	Total Doses Administered	Total number of vaccination doses administered
4.	Total Sessions Conducted	Total number of sessions conducted
5.	Total Sites	Total number of sites
6.	First Dose Administered	Total number of first dose administered
7.	Second Dose Administered	Total number of second dose administered
8.	Male (Individuals Vaccinated)	Total number of male vaccinated details
9.	Female (Individuals Vaccinated)	Total number of female vaccinated details
10.	Transgender (Individuals Vaccinated)	Total number of transgender vaccinated details
11.	Total Covaxin Administered	Total number of Covaxin Administered
12.	Total CoviShield Administered	Total number of CoviShield Administered
13.	Total Sputnik V Administered	Total number of Sputnik V Administered

Sl. No.	Attribute	Description
14.	Adverse event following immunization (AEFI)	Total number of AEFI Administered
15.	18-45 years (Age)	Vaccination details of people between 18-45 years of age
16.	45-60 years (Age)	Vaccination details of people between 45-60 years of age
17.	60+ years (Age)	Vaccination details of people above 60 years of age
18.	Total Individuals Vaccinated	Total number of individuals vaccinated

The Table 5 gives the state-wise statistical data of Indian people affected with CoV. The data is captured between the period of January 2020 to July 2021. The Recovery Rate is calculated as shown in equation (1) and the Mortality Rate is calculated as shown in equation (2).

$$Recovery\_Rate = \left(\frac{Cured}{Confirmed} * 100 \right). \tag{1}$$

$$Mortality\_Rate = \left(\frac{Deaths}{Confirmed} * 100 \right). \tag{2}$$

During the EDA analysis, it is observed that Maharashtra reported the highest number of confirmed cases (6113335) and death cases (123531) and the second highest being Kerala. Telangana and Mizoram have the slowest recovery rate of 81.6% and 82.97% respectively and Punjab state has the highest mortality rate of 2.7% followed by Uttarakhand state of 2.15%. The top five states with active number of coronavirus cases are Maharashtra, Karnataka, Kerala, Tamilnadu and Uttar Pradesh and the lowest cases are reported by Daman & Diu, Dadra & Nagar Haveli, Andaman & Nicobar Islands, Lakshadweep and Arunachal Pradesh. Maharashtra again recorded the highest number of deaths followed by Karnataka, Tamilnadu, Delhi and Uttar Pradesh.

Table 5. Statistical details of CoV in India

State/ Union Territory	Confirmed	Cured	Deaths	Recovery Rate (%)	Mortality Rate (%)
Maharashtra	6113335	5872268	123531	96.056702	2.020681
Kerala	2996094	2877557	13960	96.043615	0.46594
Karnataka	2859595	2784030	35526	97.357493	1.242344
Tamil Nadu	2503481	2435872	33132	97.2994	1.323437
Andhra Pradesh	1908065	1861937	12898	97.582472	0.675973
Uttar Pradesh	1706818	1682130	22656	98.553566	1.327382
West Bengal	1507241	1472132	17834	97.670645	1.183222
Delhi	1434687	1408853	25001	98.199328	1.74261
Chhattisgarh	996359	977893	13462	98.146652	1.351119
Rajasthan	952836	942882	8942	98.955329	0.938462
Odisha	927186	897362	4299	96.783385	0.463661
Gujarat	823964	811699	10072	98.511464	1.222384
Madhya Pradesh	790042	780578	9017	98.802089	1.141332
Haryana	769030	758442	9506	98.623201	1.236103
Bihar	722746	711913	9612	98.501133	1.329928
Bihar	715730	701234	9452	97.974655	1.32061
Telangana	628282	613124	3703	97.587389	0.589385
Punjab	596736	578590	16131	96.959124	2.703205
Assam	522267	493306	4717	94.454752	0.903178
Jharkhand	346038	340365	5118	98.360585	1.479028
Uttarakhand	340882	332006	7338	97.396166	2.152651
Jammu and Kashmir	317481	309554	4345	97.503158	1.368586
Himachal Pradesh	202945	198134	3485	97.629407	1.717214
Goa	167823	162787	3079	96.999219	1.834671
Puducherry	118227	114673	1763	96.993918	1.491199
Manipur	73581	66132	1218	89.876463	1.655319
Tripura	68612	63964	701	93.225675	1.021687
Chandigarh	61752	60837	809	98.518267	1.310079
Meghalaya	52358	47173	880	90.097024	1.680736
Arunachal Pradesh	37879	34525	181	91.14549	0.477837
Nagaland	25619	23982	503	93.610211	1.963387
Mizoram	22155	18383	98	82.974498	0.442338
Sikkim	21403	19200	309	89.70705	1.443723
Ladakh	20137	19733	204	97.993743	1.013061
Dadra and Nagar Haveli and Daman and Diu	10575	10532	4	99.593381	0.037825
Lakshadweep	9947	9643	49	96.943802	0.492611
Andaman and Nicobar Islands	7487	7343	128	98.076666	1.70963

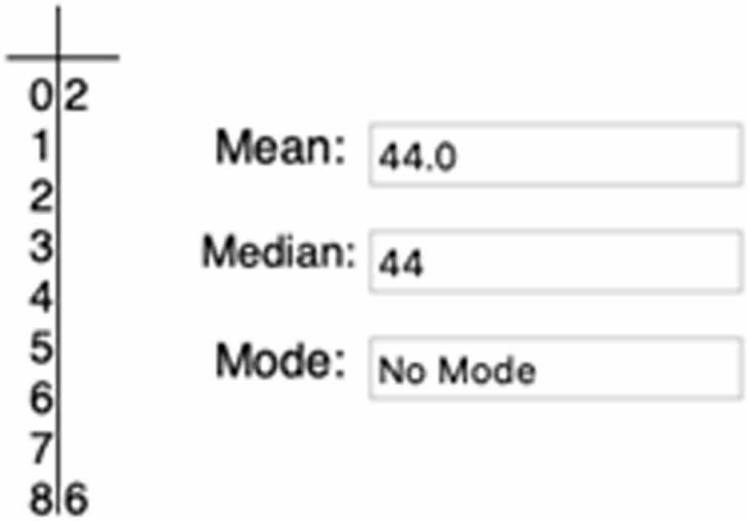
The basic CoV statistics observed while EDA is as follows:

- Total number of States with Disease Spread: 42
- Total number of Confirmed Cases: 30663665
- Total number of Recovered Cases: 29799534
- Total number of Deaths Cases: 404211
- Total number of Active Cases: 459920
- Total number of Closed Cases: 30203745
- Approximate number of Confirmed Cases per Day: 58407.0
- Approximate number of Recovered Cases per Day: 56761.0
- Approximate number of Death Cases per Day: 770.0
- Approximate number of Confirmed Cases per hour: 2434.0
- Approximate number of Recovered Cases per hour: 2365.0
- Approximate number of Death Cases per hour: 32.0
- Number of Confirmed Cases in last 24 hours: 43733
- Number of Recovered Cases in last 24 hours: 47240
- Number of Death Cases in last 24 hours: 930

The univariate graphical representation is done using Stem and Leaf, BoxPlot and Bar Graph methods. Figure 3 is the Stem and Leaf representation of COVID-19 data of India as per Table 2 data. The Stem and Leaf representation are done only for the confirmed cases in India. The representation is shown in Figure 3.

The Figure 3 also has Mean, Median and Mode calculated for the considered dataset. The Figure 4 represents the BoxPlot representation of COVID-19 data as per Table 2. The BoxPlot representation is done only for the confirmed and cured cases in India. The Median, Quartile and Outlier calculation is as shown in Table 6.

Figure 3. Stem and leaf representation of CoV dataset.



The Statewise Testing details are depicted in Figure 5. Uttar Pradesh has recorded the highest total samples of 59.33166 million, the second being Maharashtra with 42.90829M and the last being Diu and Daman with total samples of 7241000.

Figure 4. BoxPlot representation of confirmed and cured cases

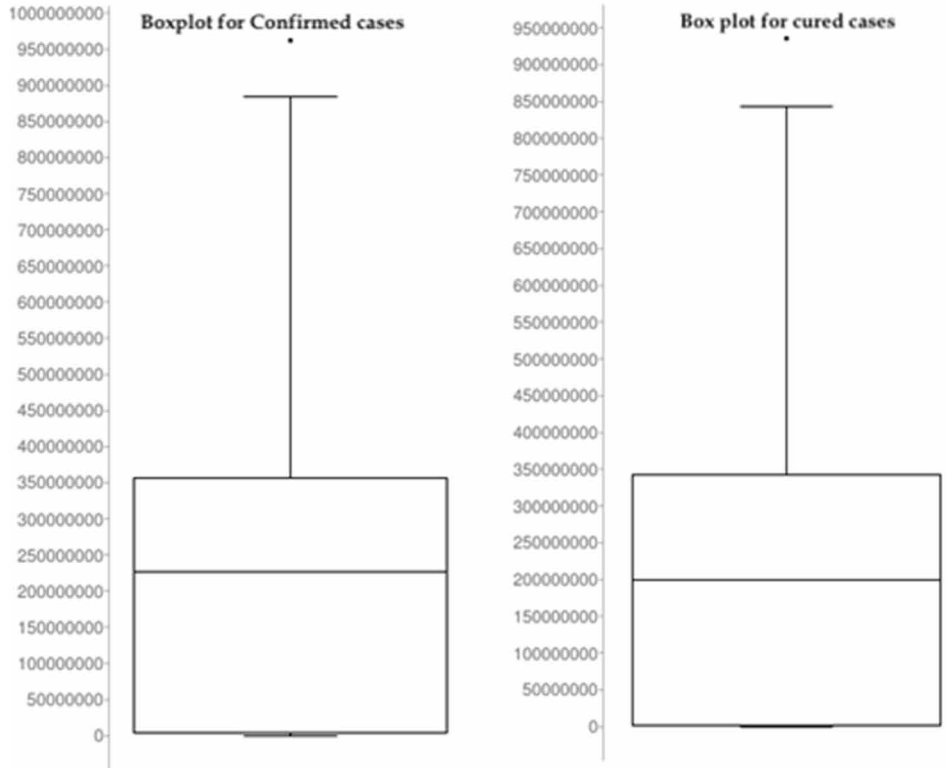


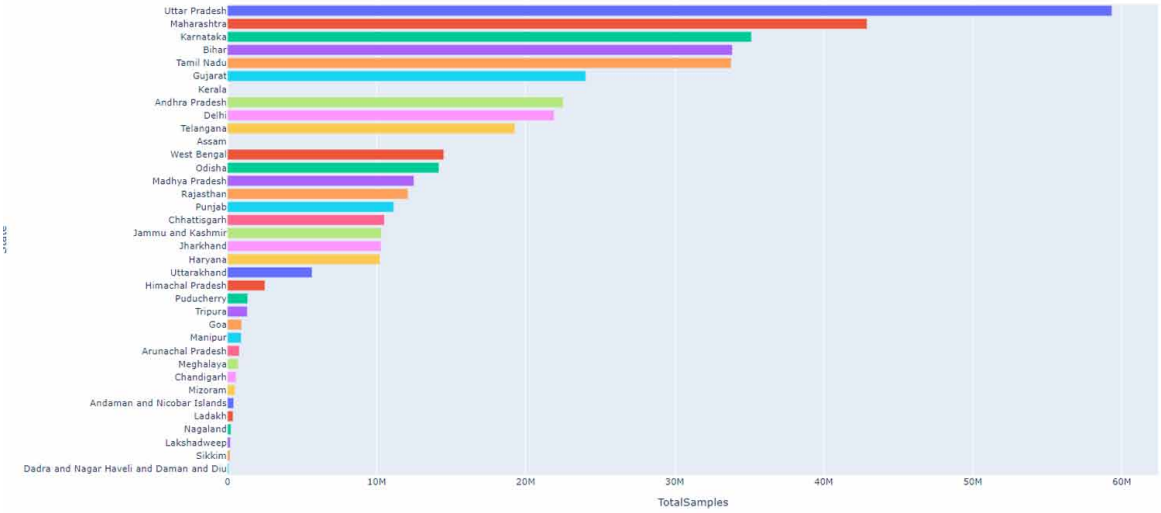
Table 6. Median and quartile calculations for COVID -19 Indian data

Sl. No.	Confirmed Cases	Cured Cases
1.	Median: 226770312	Median: 198824412
2.	Minimum: 2	Minimum: 0
3.	Maximum: 961636364	Maximum: 935289657
4.	First quartile: 2938234	First quartile: 1133341
5.	Third quartile: 356305616	Third quartile: 342616397
6.	Interquartile Range: 353367382	Interquartile Range: 341483056
7.	Outlier: 961636364	Outlier: 935289657

Prime Minister Narendra Modi announced a national lockdown on 24 March 2020 and the details are as follows:

- No lockdown= 2020-01-30 to 2020-03-24
- lockdown 1= 2020-03-24 to 2020-07-15
- Lockdown_2= 2020-07-15 to 2020-11-04
- Lockdown_3= 2020-11-04 to 2021-02-19
- Lockdown_4= 2021-02-19 to 2021-05-31
- Unlock_1= 2020-06-01 to 2020-06-30
- Unlock_2= 2020-07-01 to present

Figure 5. Statewise testing details



The growth rate during lockdown and unlock period is as follows:

- Average Active Cases growth rate in Lockdown 1.0: 1.06
- Median Active Cases growth rate in Lockdown 1.0: 1.04
- Average Active Cases growth rate in Lockdown 2.0: 1.00
- Median Active Cases growth rate in Lockdown 2.0: 1.01
- Average Active Cases growth rate in Lockdown 3.0: 0.99
- Median Active Cases growth rate in Lockdown 3.0: 0.99
- Average Active Cases growth rate in Lockdown 4.0: 1.03
- Median Active Cases growth rate in Lockdown 4.0: 1.03
- Average Active Cases growth rate in Unlock 1.0: 1.03
- Median Active Cases growth rate in Unlock 1.0: 1.03

Figure 6 gives the graphical representation of lockdown wise growth factor of active cases in India. Active cases are calculated as shown in equation (3).

$$Active\_Cases = Confirmed - Cured - Deaths. \quad (3)$$

Figure 6. Lockdown wise growth factor of active cases in India

The vaccination details too are analyzed. The male to female vaccinations are in a ratio of 53.2% and 46.8% respectively. The top five vaccinated states are Maharashtra, Uttar Pradesh, Rajasthan, Gujarat and West Bengal. The results are shown in Figure 7. Figure 8 gives the statistics of Covaxin and Covi-Shield Vaccinated Details and Figure 9 gives the top five vaccinated states of India. Figure 10 depicts the variations of COVID-19 positive test results (percentage) from April to August 2020.

Since the COVID-19 epidemic began in early 2020, governments all over the world have taken various methods to deal with it. Countries established a variety of laws and restrictions to stop the virus from spreading, decrease the outbreak's effects, and provide effective control measures. Despite the fact that the pandemic has been ongoing for over a year, few researchers have looked into its long-term effects.

Figure 7. Male and female vaccinated ratio

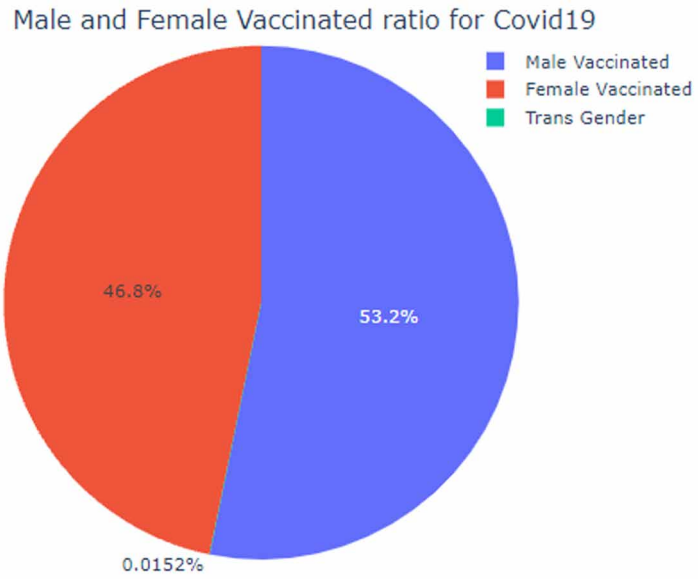


Figure 8. Covaxin and CoviShield vaccinated details

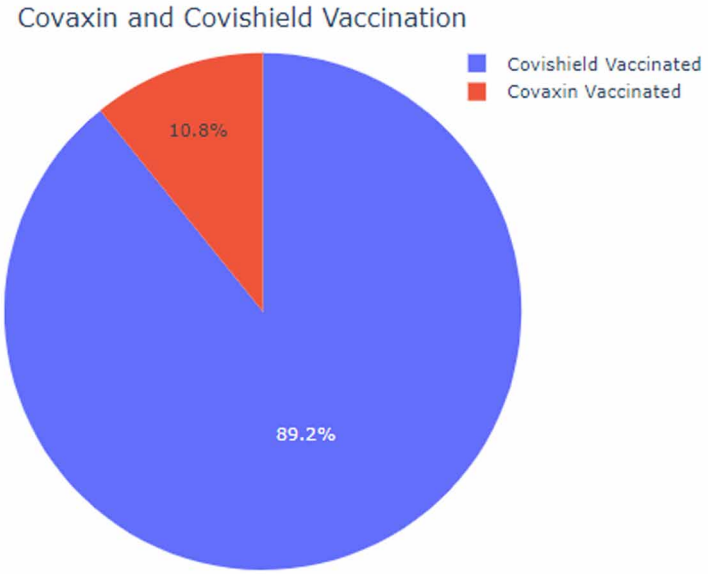


Figure 9. Topmost five vaccinated states of India

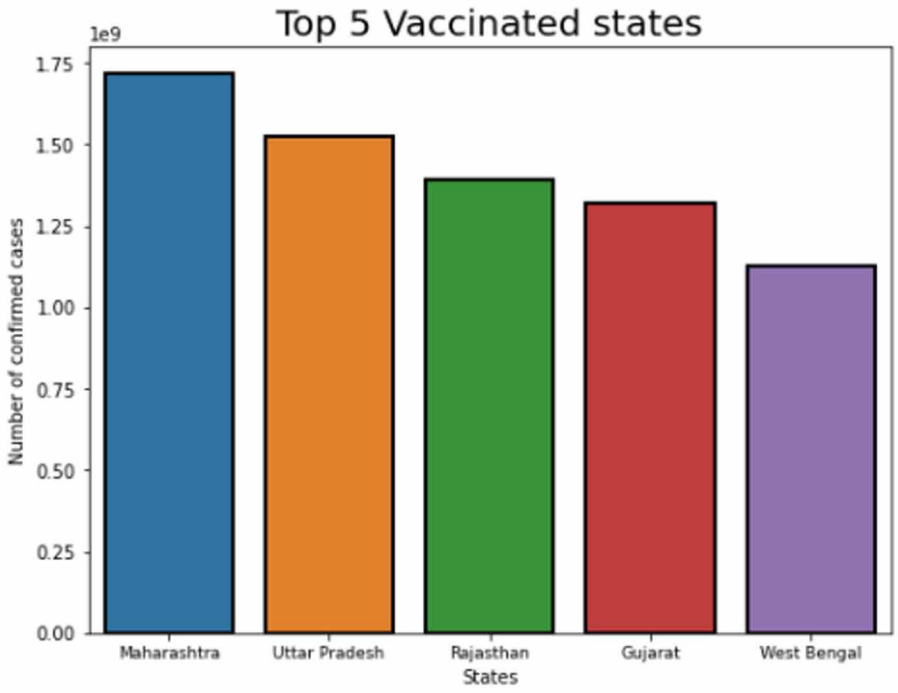
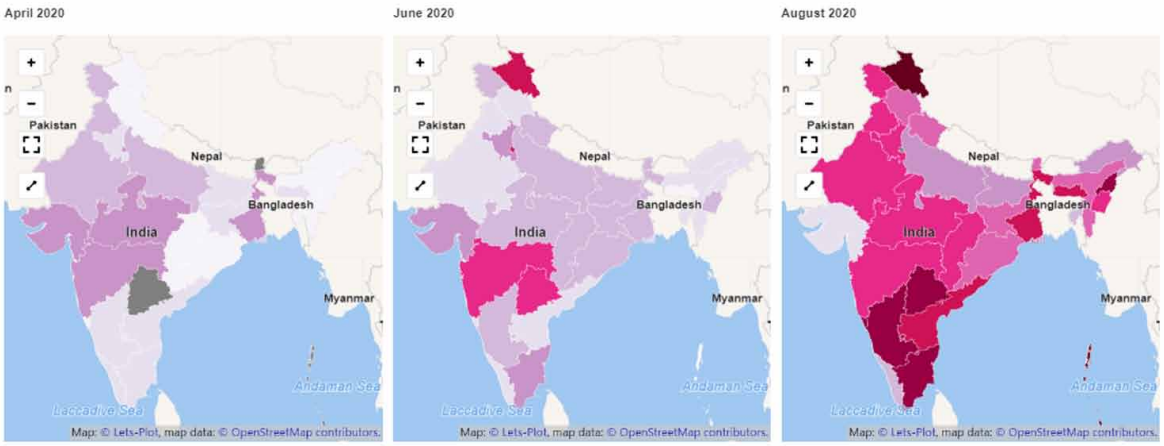


Figure 10. COVID-19 Positive Test Results (Percentage) from April to August 2020



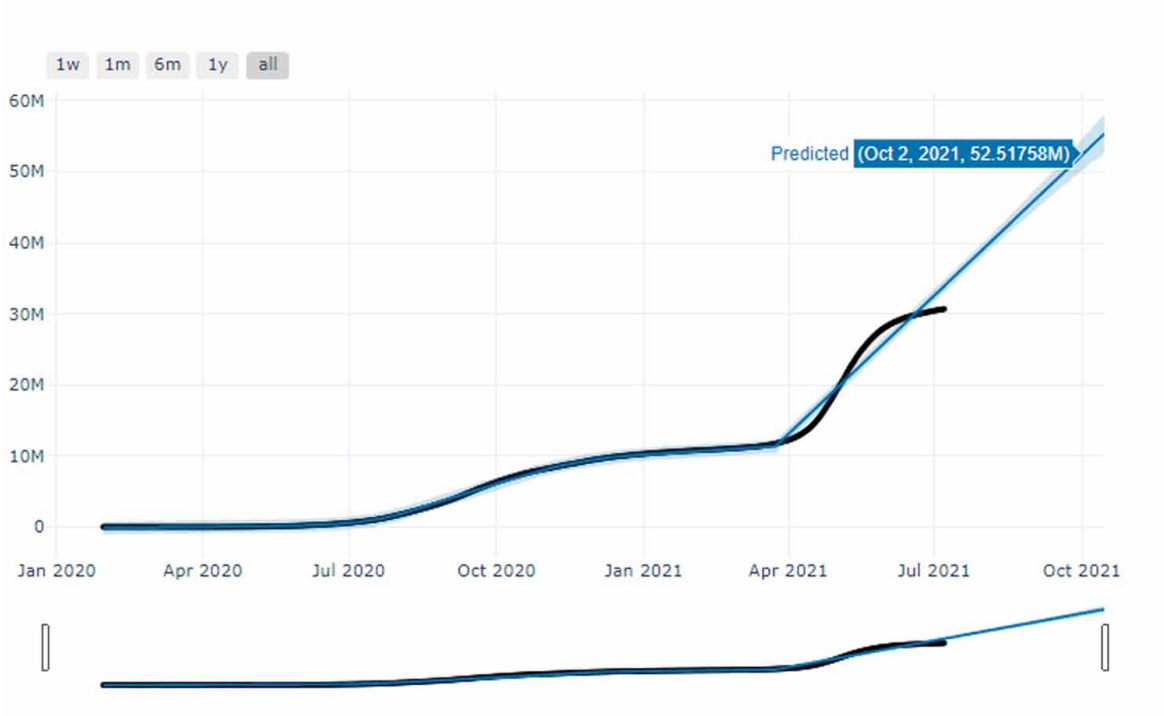
The current COVID-19 outbreak has prompted an EDA using Python on the datasets obtained, with the goal of studying the spread and trend of COVID-19 in different Indian states. The EDA dataset goes through normalization, filtering to select critical columns, deriving new columns, and presenting the data in a graphical way. To process and extract information from the given dataset, this study used the Python data processing tool and Pandas packages. For better visualization, appropriate graphs are constructed, and the Python tools Matplotlib and Seaborn are used for the same.

COVID-19 Prediction Analysis

After the effective visualization of the statistical data through EDA, the second step is to present the predictions of the data that has been read. The predictions on the data are done with the help of ML techniques (Shinde, G. R. et al., 2020). Some of the important prediction algorithms that are used in this study are AutoRegressive Integrated Moving Average (ARIMA), Seasonal Auto Regressive Integrated Moving Average (SARIMA) (ArunKumar, K. E. et al., 2021), FBProphet, Polynomial Regression, Linear Regression, Support Vector Regression, AutoRegression, Moving Average, Holt's Linear and Holt's Winter models. These mentioned techniques are discussed in detail in the following subsections with the example of the COVID-19 India data.

1. *FBProphet:* The FBProphet library, which is created by Facebook and is primarily used for time series forecasting, is used in the prediction analysis in this study (Darapaneni, N. et al., 2020). FBProphet is a time series data forecasting process based on an additive model in which non-linear trends are fit with yearly, weekly, and daily seasonality, as well as holiday impacts. It works best with time series with substantial seasonal influences and historical data from multiple seasons. Using FBProphet, the prediction is done for 60 days (till 10th October 2021). As per 2nd October 2021, the actual confirmed cases observed is 6312584. And the prediction accuracy by FBProphet is 83.19%. The prediction analysis is shown in Figure 11.

Figure 11. COVID-19 prediction analysis using FBProphet model



2. *Linear Regression:* On the basis of independent variables, regression models are statistical sets of processes that are used to estimate or forecast the target or dependent variable. There are many different types of regression models, including Linear Regression, Ridge Regression, Stepwise Regression, and Polynomial Regression. A simple model for determining the relationship between a dependent and an independent variable is Linear Regression (Darapaneni, N. et al., 2020). The association between a dependent (COVID-19 Confirmed Cases) and independent variables is shown in equation 4. In the Linear Regression model, each univariate analysis is utilized to indicate how much each independent variable will be predicted by the dependent variable.

$$C = \beta 0 + \beta 1 x_{1} + \ldots + \beta n x n + \epsilon \quad (4)$$

where C is the total number of Confirmed COVID-19 cases in India, x1, x2, ..., xn are n independent variables, β *i*s the intercept and coefficients and ϵ is the error of the Linear Regression Model. Figure 12 gives the prediction analysis of the CoV dataset using Linear Regression Model.

The Linear Regression Model appears to be collapsing in Figure 12. As can be seen, the trend of Confirmed Cases is far from linear. In order to overcome this drawback, Polynomial Regression is used in this study. The prediction results are depicted in Figure 13.

Figure 12. COVID-19 prediction analysis using linear regression model

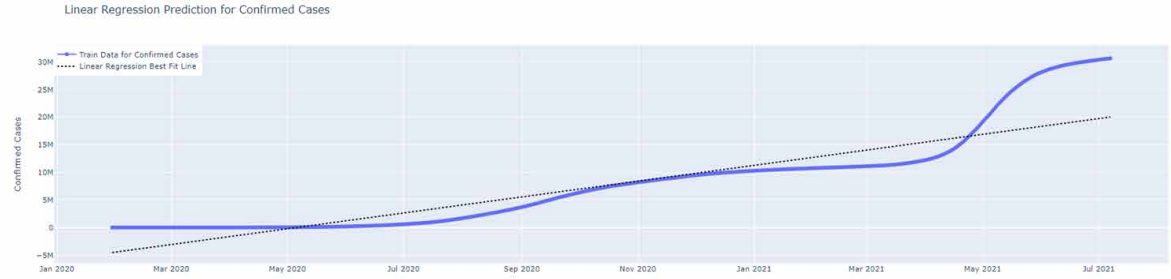
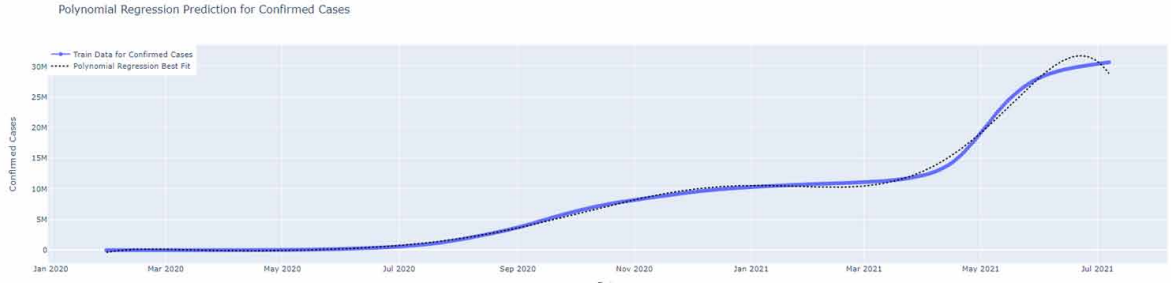


Figure 13. COVID-19 prediction analysis using polynomial regression model



3. *Support Vector Regression:* For both linear and nonlinear regression types, Support Vector Regression (SVR) is a common choice for prediction and curve fitting. SVR is built on Support Vector Machine (SVM) elements, where support vectors are essentially closer points towards the created hyperplane in an n-dimensional feature space that distinguishes the data points regarding the hyperplane (Saba, T. et al., 2021). Because the cost function for developing the model is unconcerned with training points outside the margin, the model built by classification of support vectors is solely dependent on a subset of training data. Similarly, because the cost function ignores samples whose prediction is close to their objective, the model built by Support Vector Regression is based entirely on a subset of training data. The equation for the hyperplane is given in equation (5). CoV prediction analysis using SVR is shown in Figure 14.

$$y = \beta x + \varepsilon \tag{5}$$

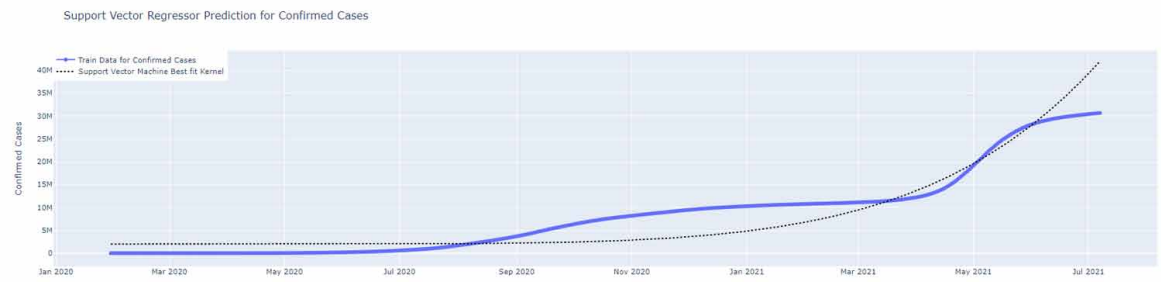
where y is the total number of Confirmed Cases, x is the independent variable, β is the intercept and ε is the error term. The decision boundary equations are shown in the equation (6):

$$\beta x + \varepsilon = +a \text{ and } \beta x + \varepsilon = -a. \tag{6}$$

As a result, equation (7) shows the hyperplane equation that should satisfy SVR.

$$-a < y - \beta x - \varepsilon < +a. \tag{7}$$

Figure 14. COVID-19 prediction analysis using support vector regression model



It is observed from Figure 14 that the SVR model isn't producing good results, since the forecasts are either overshooting or falling short of expectations.

4. Ho*lt's Linear Model: S*tatistical and structural models are the two types of forecasting models. The functional link between future and actual values of the time series, as well as external influences, is set analytically in statistical models. The following are the different types of statistical models – Regression, AutoRegressive and Exponential Smoothing models. Holt's Linear Model is an exponential smoothing method for smoothing time series in which the computational operation comprises the processing of all prior observations while taking into account the aging of data as it approaches the forecast period (Maurya, S. & Singh, S., 2020). The exponential smoothing method allows for the estimation of trend parameters that characterize the trend that has formed since the last observation, rather than the average level of the process. Three equations make Holt's model. The first is the equation for data smoothing. The trend smoothing equation is the second, and the forecast equation for the period t = k is the last. Equations (8), (9), and (10) are the formulae, respectively.

$$at = \alpha yt_{+}(1-\alpha)\left(a_{t-1} + b_{t-1}\right) \tag{8}$$

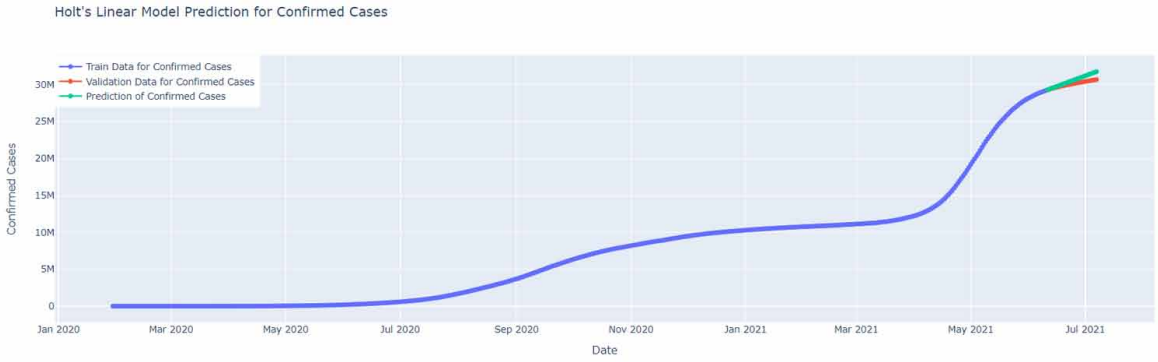
$$b_t = \beta\left(a_t - a_{t-1}\right) + \left(1-\beta\right)b_{t-1} \tag{9}$$

$$y_{t+k} = a_t + b_t k \tag{10}$$

where a_t is the smoothed value of the anticipated indicator for period *t,* b_t is the growth trend estimate, α is the smoothing parameter ($0 \le \alpha \le 1$), β is the parameter used for smoothing ($0 \le \beta \le 0$), and k is the number of time periods for which the forecast is produced.

The smoothing parameters α and β are chosen subjectively by the forecaster based on previous forecasting experience or by minimizing forecast error. When the smoothing parameters are large, which tend to zero, the model's response to changes in the data is stronger, and the structure of the smoothed values is less even. When the smoothing parameters are small, which tend to zero, the model's response to changes in the data is weaker, and the structure of the smoothed values is less even. Figure 15 demonstrates CoV prediction analysis using Holt's Linear Model.

Figure 15. COVID-19 prediction analysis using Holt's Linear Model

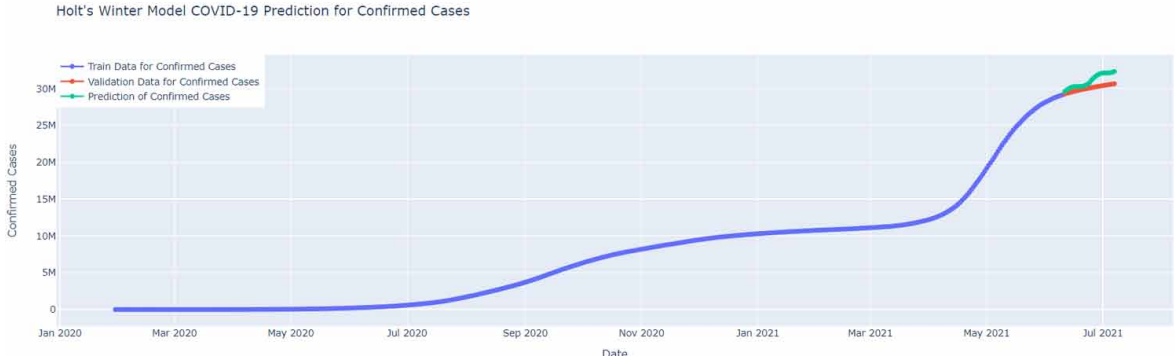


5. *Holt's Winter Model:* The Holt-Winters technique is a popular time series forecasting approach that can account for both trend and seasonality. The Holt-Winters approach is made up of three other smoothing methods (Maurya, S. & Singh, S., 2020).

    - Simple Exponential Smoothing (SES) presupposes that the level of the time series remains constant. As a result, it can't be utilized with series that have both trend and seasonality.
    - Holt's Exponential Smoothing (HES): HES is a step up from simple exponential smoothing because it includes a trend component in the time series data.
    - Winter's Exponential Smoothing (WES): WES is a Holt's exponential smoothing extension that finally incorporates seasonality. The Holt-Winters method is the name given to Winter's exponential smoothing.

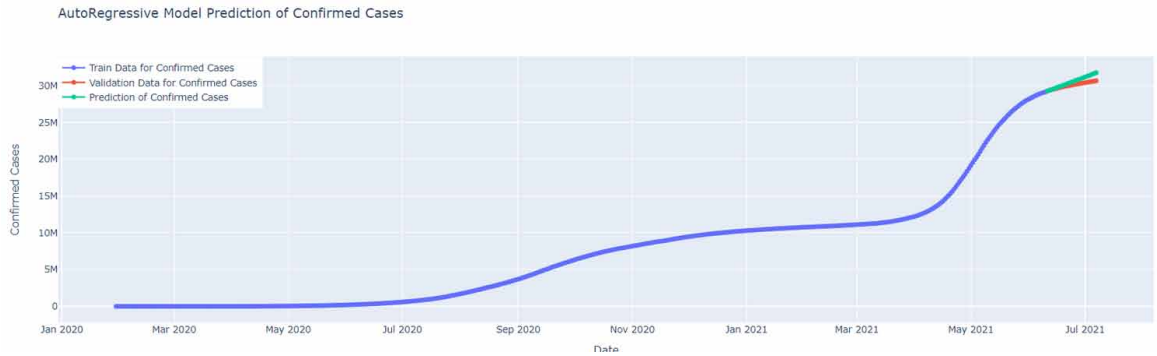
As a result, the Holt-Winters approach is frequently referred to as triple exponential smoothing, because it is essentially a combination of three smoothing methods stacked on top of one another. Figure 16 demonstrates CoV prediction analysis using Holt's Winter Model.

Figure 16. COVID-19 prediction analysis using Holt's Winter Model



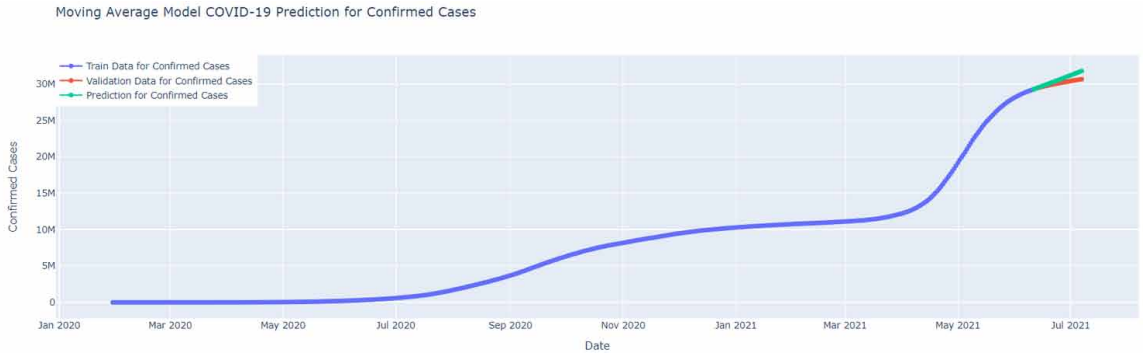
6. *Auto Regressive Model:* An autoregression is a time series model that predicts the value at the next time step by using observations from past time steps as input to a regression equation. It's a simple concept that can produce reliable forecasts for a variety of time series issues (ArunKumar, K. E. et al., 2021). The prediction analysis using this model is shown in Figure 17.

Figure 17. COVID-19 prediction analysis using AutoRegressive Model



7. *Moving Average Model:* A moving average is a method of calculating and analyzing data in statistics and economics by providing a series of averages of various subsets of the dataset. A Simple Moving Average (SMA) is defined as the unweighted mean of preceding data or an equal number of data points on either side of a center value (in science or engineering). SMA too is used for prediction analysis in this chapter. The prediction results are shown in Figure 18.

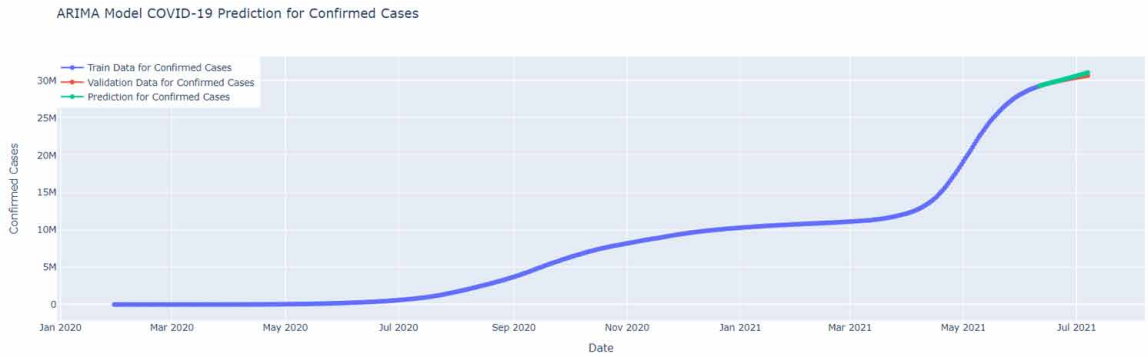
Figure 18. COVID-19 prediction analysis using Moving Average Model



8. *AutoRegressive Integrated Moving Average (ARIMA Model):* Data on a given occurrence is collected via time series forecasting, and a model is developed to depict the underlying link between the variables. The model is then used to extrapolate time series data to forecast future event values. This approach is useful for forecasting future behaviour when there isn't a meaningful link between the two factors. The most often used time series model is the Autoregressive Integrated Moving Average (ARIMA) model (ArunKumar, K. E. et al., 2021).

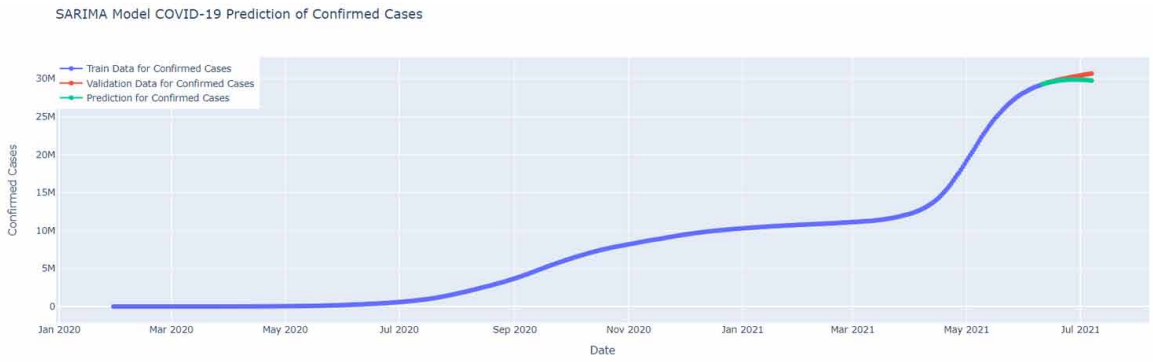
ARIMA captures extremely complicated relationships as it includes error factors and delayed data. These models are created by regressing a variable against its previous values (ArunKumar, K. E. et al., 2021). The ARIMA model is based on the notion that previous time points in a series can impact present and future time points. ARIMA model's CoV prediction analysis is shown in Figure 19.

Figure 19. COVID-19 prediction analysis using ARIMA Model



9. *Seasonal AutoRegressive Integrated Moving Average (SARIMA Model):* This model is distinct from an ARIMA model in that it is based on seasonal patterns rather than time. Seasonal impacts are widespread and may be extremely large in many time series data sets. Figure 20 demonstrates SARIMA model's prediction analysis for COVID-19 dataset (ArunKumar, K. E. et al., 2021).

Figure 20. COVID-19 prediction analysis using SARIMA Model



Comparative Analysis of Prediction Models

Performance of all 10 models is compared using a statistical measure namely Root Mean Squared Error. Table 7 shows the comparative analysis. It is observed from Table 7 that AR performs better when compared to other models. The performance predictions of MA and SARIMA are close to each other and Linear Regression has predicted less when compared to other models.

The lack of data on COVID-19 makes modeling and prediction difficult. The data from cumulative confirmed cases in India is modeled using 10 distinct methodologies in this study. According to the findings, the Auto Regressive Model has a substantially higher success rate than ARIMA, Moving Average, and the other models included in the study.

Table 7. Comparative analysis of RMSE values of COVID-19 prediction models

Model Name	Root Mean Squared Error (RMSE)
Auto Regressive Model (AR)	176891.262332
Moving Average Model (MA)	427826.5262134
SARIMA Model	437422.329164
Holt's Linear Model	574341.509304
Holt's Winter Model	592496.781198
ARIMA Model	719831.008192
Facebook's Prophet Model	719831.008192
Polynomial Regression Model	1411334.739950
Support Vector Machine Regressor Model	6990167.647466
Linear Regression Model	10624435.202866

Identification of CoV Misconceptions in Social Media Networks

This sub-section aims primarily to recognize misconceptions on COVID-19 that are shared in Twitter®. COVID-19 is a disease attributed to a newly identified virus namely coronavirus. People have expressed

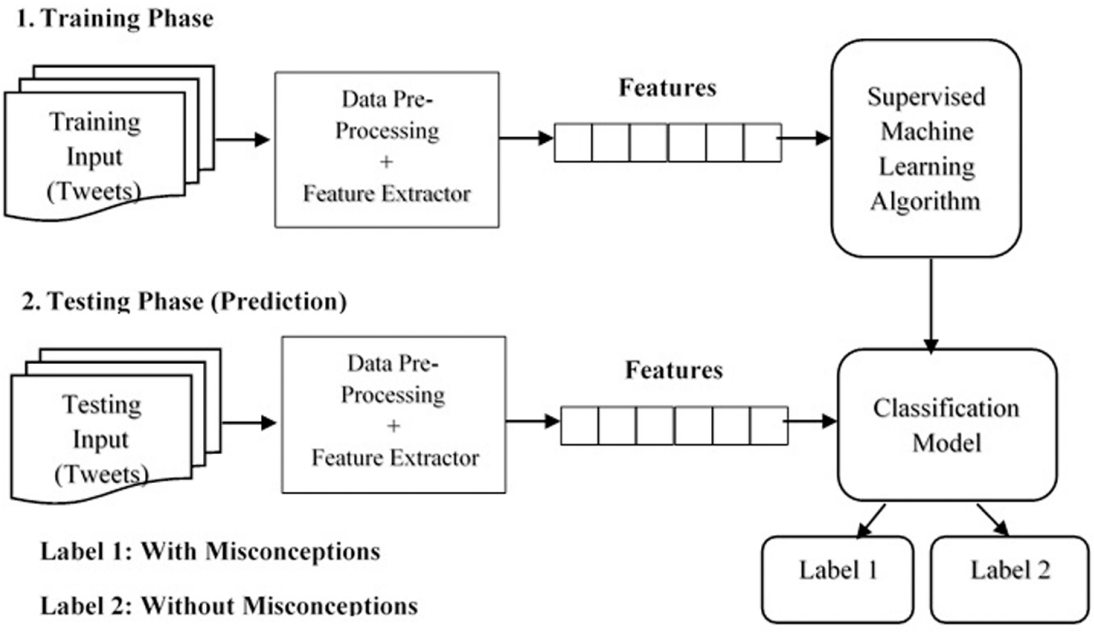
their thoughts and views regarding the onset of coronavirus. Some of them are right, while others are myths. Most negative knowledge is found in myths. Relevant and reliable knowledge for this study is sought from the World Health Organization (WHO).

Introduction to Coronavirus Misconceptions: In this case study, the effectiveness of the identification systems of misconceptions has been checked on corona pandemic dataset from Twitter® messages. In the classification of the dataset in two groups, a combination of Forward Scan Trigrams and a weighted TF-IDF model is subjected to a supervised classification: one with misconceptions about the COVID-19 virus and the other containing the correct and authenticated details (Kokatnoor, S. A. & Krishnan, B., 2020).

Identification of Misconceptions Architecture: The classification of texts including unstructured text data must take place through various phases, including preprocessing, input text transformation into a vector of features, identification of meaningful patterns and final analysis of the model. The proposed architecture is as shown in Figure 21. The text corpus is divided into two sets, training and testing datasets in the ratio of 80:20 respectively. The training dataset after preprocessing and Feature Engineering process (Kokatnoor, S. A. & Krishnan, B., 2020) is converted into Vector Space Model (VSM). This VSM trains and builds a model using the standard supervised machine learning classification algorithm. The model built is tested on the testing dataset to accurately classify into binary classes, one with misconceptions and the other being labeled as correct information.

Collection of Tweets on Coronavirus: To identify the misconceptions about coronavirus outbreak, Twint Python Library is used. Using this library, 1568 tweets are collected between 1st March 2021 and 15th September 2021. In which 31 tweets are manually deleted from the file which is posted in other languages using English. Later on, the tweets are manually annotated in two labels 0 and 1 using the information from legitimate and authenticated sources like the World Health Organization (WHO), British Broadcasting Corporation (BBC) and mygov.in. A '0' demonstrates tweets that include misconceptions of coronavirus and '1' shows the authenticated details.

Figure 21. Architectural diagram for the identification CoV misconceptions



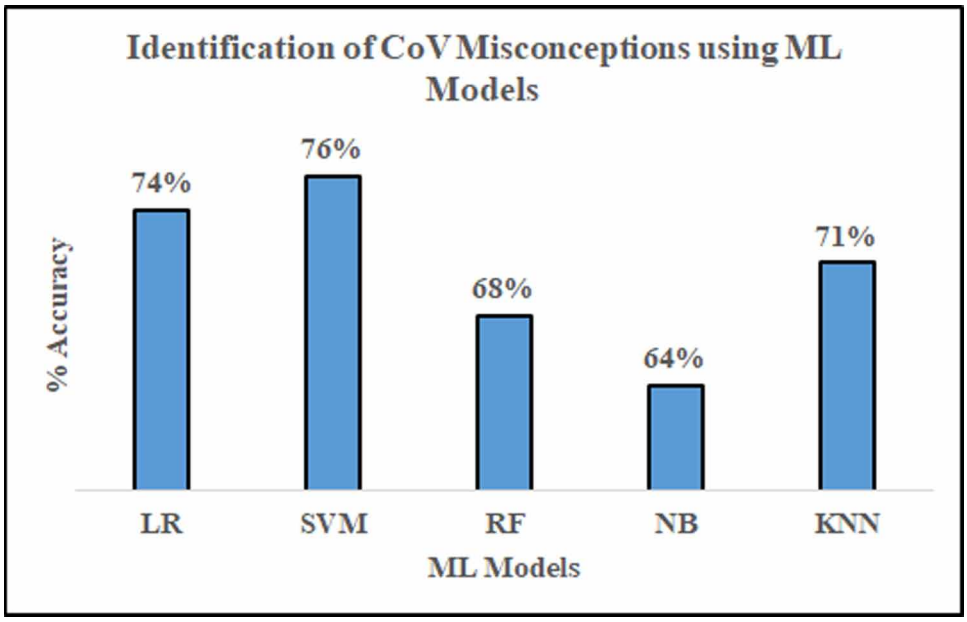
Text-Preprocessing and Feature Engineering: Extracted text corpus from Twitter® is preprocessed using NLTK 3.1 tool (Saad, S. E. & Yang, J., 2019). For creating a standard text dataset, the following procedures are used. The text is transformed to a lower case to reduce the text dataset volume. The special characters and whitespaces are removed. The stop words of the dataset with no insight into the semantic content of the document are deleted. The words that have similar semantic characteristics, but have different forms, are reduced to a generic root word. For the preprocessed text corpus, a combination of Forward Scan Trigrams and weighted TF-IDF method is applied for text vectorization (Kokatnoor, S. A. & Krishnan, B., 2020). With this an efficient VSM is created which is input to five supervised machine learning algorithms for comparative studies, namely Naïve Bayes (NB), K-Nearest Neighbour (KNN), Logistic Regression (LR), Support Vector Machine (SVM) and Random Forest (RF) (Varshney, D., & Vishwakarma, D. K., 2021).

Experimental Results*:* The following parameters are used for the chosen classifiers:

- The regularization parameter C is chosen as the default value 1.0 in the Support Vector Machine (SVM) standard classifier. Where C specifies how many samples contribute to the total error within the margin. With a low C, samples are penalized less within the margins than with a greater value of C. Radial Basis Function (RBF), a kernel function is chosen with SVM during the experimentation process.
- The Logistic Regression (LR) model uses L1 regularization (Lasso) or L2 (Ridge). In this study, an L2 penalty is chosen to avoid overfitting problems. Limited memory Broyden Fletcher Goldfarb Shanno (LBFGS) algorithm is used for optimizing the results. With LBFGS, the second derivative matrix updates are approximated with gradient evaluations. It saves memory only with the last few updates.
- For the K-Nearest Neighbor (KNN) classifier, K=5 is chosen. Where K is the number of neighbors. In order to find the proximity measure, p=2 is chosen where p is the power parameter for the Minkowski similarity distance calculation.
- The number of trees chosen in the Random Forest (RF) classifier is 100. Gini measure is used to find the node impurity. It measures the cumulative decrease of the node impurity over all trees of the ensemble (weighted by the likelihood of reaching this node (approximated by the proportion of samples reaching this node). The Gini impurity criterion for the two descending nodes is less than the parent node each time the split of one node is performed on a variable. Adding up the Gini decreases for each individual variable over all trees in the forest. During the experimental process the minimum number of samples required to split an internal node is 2.

SVM has yielded good results when compared to other models during the experimentation process. The output results are displayed using a statistical metric, namely Accuracy, where Accuracy is defined as the ratio between the correctly predicted model values and the total predictions number. The results are shown in Figure 22.

Figure 22. Comparison of ML models' accuracy scores



To split the dataset into two classes, SVM uses the RBF kernel function and nonlinear hyperplanes, thereby accurately classifying the dataset into anomalous and non-anomalous. This along with improvised Feature Engineering has increased the performance of SVM classifiers in terms of its accuracy. Logistic Regression divides the input by a linear boundary into two classes (anomalous and non-anomalous), one for each class. The data considered must therefore be linearly separated. But the text corpus based on COVID-19 misconceptions taken from Twitter® is imbalanced and is not linearly separable. Logistic Regression between independent variables requires moderate or no multicollinearity. This means that only one of them can be used if two independent variables have a high correlation. Repeated information in the input VSM has caused the weights parameter wrongly trained while minimizing the cost function.

Besides, the presence of data values in the text corpus that vary from the expected range has led to wrong results and hence low accuracy value, as LR is sensitive to anomalies. Based on the provided training dataset, KNN created a highly complex resolution border. Due to the initial metric vector chosen and the lack of precise discrete classes, KNN is less successful. Under the conditional independence theory of Naive-Bayes, as all the probabilities are combined, a negative value is obtained as its outcome. So, Naive Bayes too performed less in terms of its accuracy. Since RF is an ensemble model, when compared to an individual Decision Tree, it is essentially uninterpretable. This ensemble model is trained with a wide variety of decision trees, which uses more memory and increased time complexity due to which it resulted in less performance.

CONCLUSION

Throughout history, humans have been subjected to epidemics and pandemics. Often, such infectious outbreaks have resulted in entire civilizations facing extinction. Despite recent clinical advances and

technology innovations, challenges such as disregarded sustainability and poor public hygiene practices, among others, have given a setting for the COVID-19 pandemic to emerge. In this context, scientific and scholarly communication utilizing a variety of open access platforms could play an important role in efforts toward preparedness and control, as well as the implementation of prompt corrective actions in the battle against epidemics and pandemics. These technologies aid in increasing understanding of scientific options for reducing infectious disease outbreaks, hence enhancing social immunity.

COVID-19 research is advancing open access and research forward at a faster rate than ever before. Preprints, for example, allow academics to disclose their study results quickly, sometimes along with their datasets. Furthermore, cross-disciplinary collaboration occurs on a regular basis, such as when a physicist is analyzing the COVID-19 dataset and suggesting a model. Data science plays a crucial role in bringing trans-disciplinary discussion between researchers and the public to address this challenge.

According to COVID-19, India's population and poor hygiene standards among the bulk of the country's people are the most concerning problems. Another issue that may come back to haunt India is a lack of medical equipment, outdated medical technology, and medical facility negligence, all of which could play a key role in this pandemic. The lack of testing and the unavailability of medical hospitals may only add to those concerns.

According to the observations made with the help of EDA, the number still seems good right now when considering the population and India. There is a silver lining, however: India implemented a Nationwide Lockdown at the appropriate time. Another good to take away is "unity in diversity," where people are working to aid others who are poor, and people are donating money to the government to combat this epidemic, which might play a huge role in this pandemic.

The people of this country will determine the course of this pandemic; forecasts may appear reasonable in contrast to other countries, but that picture might change in a matter of days. It all relies on how closely people adhere to the rules and restrictions enforced by the Indian government. The vaccination details based on the EDA looks promising. Social distancing in public settings, self-isolation if any COVID-19 symptoms are observed, quarantine of CoV positive patients, lockdown, and other measures are the only possible and effective COVID-19 precautions.

As observed through EDA, COVID-19 has a low mortality rate, which is the most favourable takeaway. Furthermore, a robust Recovery Rate indicates that the condition is treatable. The only cause for concern is the infection's exponential growth rate. Since the last few days, the number of confirmed and fatality cases has appeared to have slowed. This is a very good indicator. There should be no new country emerging as the new COVID-19 epicentre, much as the United States did for a brief while. If a new country emerges as an epicentre, the number of confirmed cases will increase dramatically.

The struggle with COVID begins and ends with the people. This pandemic can be overcome by following the steps given below:

- When everyone goes out of the house, everyone should wear a mask. Face masks are Covid-19's first line of defence.
- It is vital to maintain a gap between persons of more than 6 feet. Citizens who buy food and other important products should keep their physical distance secure.
- Unless obligatory, children under 10 years of age and older adults above 60 years of age should avoid going out.

- For flu/influenza symptoms like fever, cough, sore throat, fluid nose, difficulty breathing, headache and bodily pain, contact the government health center in the nearest city and get treatment in advance.
- Soap and hand washing facilities/sanatorium shall be supplied for the work spaces. There should be a sufficient physical distance between staff.
- The public must avoid unnecessary travel. In the absence of an unavoidable precaution, the use of face masks, frequent hand washing, sanitizer, safe physical distance etc. shall assure every measure of safety.
- Comorbid conditions such as high blood pressure, diabetes, cardiac disease, chronic kidney disease, chronic obstructive pulmonary conditions, cancer and/or all other chronic illnesses, are requested to remain indoor and avoid traveling in a way which avoids exposure to COVID-19 except for the medical treatment.

FUTURE RESEARCH DIRECTIONS

The future scope of this study can include finding the reasons behind the fresh cases of COVID-19 from the public's perception for data specific to India. The analysis can be focused on finding the reasons attributed to spread and impact of the disease, by using machine learning and deep learning approaches and validating the inferences with medical professionals. Improvised K-means clustering algorithm can be used for clustering similar data, based on the public posts from Twitter®. Then the LDA topic model can be applied for discovering the trigram topics relevant to the reasons behind the increase of fresh COVID-19 cases. The future scope may also include automated identification of root causes not only from the textual posts, but also from the emoticons, images and videos posted by the public in OSM.

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KEY TERMS AND DEFINITIONS

Artificial Intelligence (AI): AI refers to a computer or a robot controlled by a computer's capacity to do jobs that are normally performed by people because they require human intellect and judgement.

AutoRegressive Integrated Moving Average (ARIMA): ARIMA is a statistical analysis model that uses time-series data to understand a data set better or predict future patterns in the data set. Autoregressive statistical models predict future values based on the previous values.

Centers for Disease Control and Prevention (CDC): The Centers for Disease Control and Prevention (CDC) is the nation's health protection agency, operating around the clock to keep America safe from foreign and domestic health and safety risks. The CDC improves our country's health security.

Data Science (DS): Data science is an interdisciplinary subject that combines scientific techniques, procedures, algorithms, and systems to extract knowledge and insights from noisy, structured, and unstructured data.

Decision Trees (DTs): DTs are used for classification and regression in non-parametric supervised learning. The objective is to learn basic decision rules using data attributes to forecast the value of a target variable. A tree is a constant piecewise approximation.

Exponential Smoothing (ES): ES is a univariate time series forecasting approach that may be expanded to accommodate data with a systematic trend or seasonal component. It is a strong forecasting approach that may be used in place of the popular Box-Jenkins ARIMA family of algorithms.

Exploratory Data Analysis (EDA): EDA is a data analysis approach that enables the discovery of hidden information within a data collection. This technique is frequently used to derive inferences from data.

FBProphet (FP): The FBProphet library, which is created by Facebook and is primarily used for time series forecasting, is used in the prediction analysis.

Holt's Linear Model (HLM): A prominent smoothing technique for predicting data with trend is Holt's two-parameter model, sometimes known as linear exponential smoothing. Holt's model consists of three different equations that interact to provide a final forecast.

Holt's Winter Model (HWL): HWM is a time series behavior model. Forecasting usually necessitates the use of a model, and Holt-Winters is a method for modelling three components of a time series: a typical value (average), a slope (trend) across time, and a cyclical repeating pattern (seasonality).

Latent Dirichlet Allocation (LDA): The LDA is a generative statistical model that allows unobserved groups to explain why some parts of the data are similar.

Least Absolute Shrinkage and Selection Operator (LASSO): LASSO is a regression analysis approach that uses attribute selection and regularization to improve the predictability and interpretability of the final statistical model.

Linear Regression: A linear approach to modeling the relationship between a scalar response and one or more explanatory factors is known as linear regression (also known as dependent and independent variables).

Logistic Regression: Logistic regression is a statistical model that uses a logistic function to represent a binary dependent variable in its most basic form; however, many more advanced extensions exist. Logistic regression (or logit regression) in regression analysis is used to estimate the parameters of a logistic model (a form of binary regression).

LSTM-Regression: The LSTM model is a Gated Recurrent Neural Network, and bidirectional LSTM is simply an extension of that model. The crucial aspect is that these networks may save information for future cell processing.

Machine Learning (ML): ML is a sort of artificial intelligence (AI) that allows software programs to improve their prediction accuracy without being expressly designed to do so. In order to forecast new output values, machine learning algorithms use past data as input.

Neural Network (NN): A neural network is a set of algorithms that attempts to detect underlying relationships in a batch of data using a technique similar to how the human brain works. In this context, neural networks are systems of neurons that might be biological or artificial in origin.

Precision and Recall: Precision (also known as positive predictive value) is the proportion of relevant examples discovered among the recovered instances, whereas recall (also known as sensitivity) is the proportion of non-relevant instances found among the retrieved instances. Precision and recall are two different concepts. As a result, relevance determines the precision and recall of an experiment.

Predictive Analytics (PA): PA is a subset of advanced analytics that predicts future events by combining historical data with statistical modelling, data mining tools, and machine learning. Companies use predictive analytics to discover hazards and opportunities by looking for trends in data.

Random Forest (RF): Random Forest is a Supervised Machine Learning Algorithm frequently utilised in Classification and Regression applications. It constructs decision trees from several samples and uses their majority vote for classification and average for regression.

Ridge Regression: Ridge regression is a technique for estimating the coefficients of multiple-regression models when the variables are linearly independent but highly linked. It has been applied in various domains such as econometrics, chemistry, engineering, etc.

Seasonal Auto-Regressive Integrated Moving Average With eXogenous Factors (SARIMAX): SARIMAX used to forecast daily Covid-19 cases in this chapter.

World Health Organization (WHO): The WHO, dedicated to the well-being of all people and informed by science, leads and champions worldwide efforts to provide everyone, everywhere, an equal chance to live a healthy life.

Chapter 11
Combating Misinformation in the Open Access Era

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ABSTRACT

Since the early 21st century, the scholarly community has struggled with the rising cost of scientific publications and issues related to the accessibility and dissemination of scientific work and research results to the wider community. Maintaining a high quality of scientific publications and lowering the cost led to the emergence of the open access (OA) movement. OA has appeared as an essential resource to make scholarly publications available to a broader audience in the last two decades, aiming to improve access to scientific knowledge. However, the onset of the internet and social media has given rise to a tide of misinformation, resulting in diminishing trust in science. This chapter discusses the importance of OA as a trusted source in combating misinformation and adopting strategies for sustaining the OA business models. Additionally, this chapter draws on the social psychology literature and the "inoculation theory" to reason why OA as a credible source of information can protect us against misinformation.

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THE AIM OF THE CHAPTER

Man is a historical animal with a deep sense of his own past, and if he cannot integrate the past by a history explicit and true, he will integrate it by a history implicit and false.(Geoffrey Barraclough,1956).

This book chapter explains the role open access (OA) can play in combating *misinformation*. Misinformation refers to false information created accidentally or designed deliberately to be false and poses inevitable cognition and social interaction challenges due to its misleading nature (DePaulo et al., 1996; Scheufele & Krausea, 2018). A recent Reuters survey shows that concerns regarding misinformation are growing, ranging from politics to science (Newman et al., 2019; Scheufele & Krause, 2019). Therefore, as a research topic, misinformation has recently attracted considerable attention. Recent studies highlight the role of misinformation in shaping resistant-to-change misconceptions and conspiracy theories and giving rise to numerous environmental, societal, and global problems (e.g., Cook et al., 2017; 2018, Hopf et al., 2019; Iammarino & O'Rourke, 2018). For example, misconceptions regarding vaccines, also known as the anti-vaccine movement, have prolonged the COVID-19 pandemic, increased mortality and morbidity, and exacerbated health inequalities and disparities, such as increasing rates of mental health issues in the poorer and marginalized communities (Ransing et al., 2021). In addition, Silverman (2016) reports that fake news outperformed real news on Facebook, favoring a candidate during the last three months preceding the 2016 United States election. Conspiracy thinking has also caused the politicization of climate science and consequently the increasing polarization of the public concerning critical environmental issues, such as global warming. These examples indicate that misinformation can damage our critical thinking abilities, thus incurring tremendous unnecessary costs on individuals and society and threatening democracy (Cook et al., 2017; Lewandowsky et al., 2013a; Lewandowsky et al., 2013b; Oreskes, 2014).

As humans, we intuitively use our heuristics, which are mental rules of thumb, when evaluating information (Cook et al., 2017; Richter et al., 2009). This intuitive thinking, operated by "system 1," is effortless and fast with no sense of voluntary control. However, we use "system 2" for critical thinking, which is slow, more effortful, and analytical and is responsible for generating thoughts and new beliefs and making deliberate decisions and choices (Kahneman, 2011, p. 21; Norman, 2021, p. 33; Scheufele & Krause, 2019). The system-2 thinking, activated by conscious mental exertion, would enable us to judge the validity and accuracy of the information we acquire, including considering short-term benefits and long-term cost and impact of our decisions on other individuals. Recent studies suggest that more exposure to objective information increases open-mindedness and activates analytical thinking, leading to more clarity and better decision-making (Bronstein et al., 2019; Lazer et al., 2018). In other words, exposure to scientific information allows individuals to recognize their mental ability to become critical thinkers and lifelong learners and eventually re-examine their dysfunctional beliefs. As critical thinkers, we can better judge the differences between assumptions and facts by evaluating methods and instruments to arrive at the truth. Furthermore, critical thinking minimizes the risk of confirmation biases, which is unconsciously favoring information that aligns with our belief system. By contrast, exposure to counterfactual information weakens our analytical thinking. A lack of critical thinking is linked to inaccurate beliefs, delusionality, dogmatism, and religious fundamentalism (Bronstein et al., 2019; Pennycook et al., 2012).

Exposure to "scientific consensus" is known as "prebunking." Prebunking seeks to help people recognize and resist subsequently encountered misinformation (Van der Linden et al., 2017). Several experimental

studies demonstrate that prebunking prevents misinformation from taking root in people's minds and is a more effective method than "debunking," which is to correct the influence of misinformation on the mind (Banas & Rains, 2010; Bolsen & Druckman, 2015; Cook, 2015; Cook & Lewandowsky, 2011). This technique was proposed based on the "inoculation theory," which insinuates the relative efficacy of prior belief-defense in producing immunity against persuasion by exposure to misinformation (McGuire, 1961; McGuire & Papageorgis, 1961). However, it is noteworthy that recent research studies reinforce the idea that any combination of prebunking and debunking interventions, which can strengthen public trust, could substantially reduce the spread of misinformation (Bak-Coleman et al., 2021; Ecker et al., 2022).

It is crucial to point out that having access to accurate; trusted information is a fundamental right and vital for building a democratic society, minimizing, or eliminating systemic racism and disparities. Access to scientific information allows us to enhance our mental immunity and develop the ability to critically examine information coming our way through asking the right questions and filtering information containing oversimplified exaggerations (Norman, 2021, p. 200). Critical thinking is essential for evaluating information and determining what is false. Thus, the more we eradicate inaccurate information, the closer we get to the truth (Iammarino & O'Rourke, 2018).

As such, this chapter provides insights into how the status of OA as a trusted source can help us, as a society, fight back misinformation.
The chapter is organized as follows:

1. The emergence of the OA movement will be explained, followed by a detailed discussion of its challenges, opportunities, and controversies.
2. The role of the internet and social media in the rise of misinformation, and the effect of information technology on validating knowledge, will be described.
3. Finally, a discussion of OA's role as a trusted source for addressing the misinformation problem will be provided.

THE OA MOVEMENT

Scholars and researchers exchanged research findings through informal communication methods until the first scientific journal under the title "Philosophical Transactions of the Royal Society of London" was launched in 1665. Since then, scholarly publications have been made available through scientific and professional associations, libraries, and publishers. The commercialization of books and journals through publishers happened right after the invention of the printing press and the creation of mechanical movable printing devices leading to mass communication. The goal of science has always been the distribution of knowledge beyond monetary and copyright limitations. However, commercial publishers dominated the market, resulting in access restrictions to scholarly journals' content after World War II. The publishing industry's shift of focus to making large profits from journal subscriptions led to the locking of the scholarly content behind the journal's paid walls. The commercialization of the journal content, in turn, has imposed more restrictions on researchers' access to high-quality research materials; especially the researchers from developing countries were the worst hit (Alemu, 2009; Bjork & Solomon, 2012; Dulle et al., 2011).

In recent decades, the transition from print to electronic and the rapidly growing journal subscription prices created the need for alternative ways to improve access and remove or reduce the disparity

in accessing scholarly content from across the scholarly community. Consequently, the OA movement emerged in the early years of the new century. The OA's primary goal is to support the widespread distribution of peer-reviewed electronic journal literature to make it affordable for researchers from developing countries to access high-quality research content (Nobes, 2016). The release of the "Budapest Open Access Initiative" (BOAI), the first public statement about OA principles, brought more attention to the movement (Chen et al., 2002; Suber et al., 2003). Following that, the publication of the "Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities" and many other local initiatives and policies aimed to raise awareness of the OA principles within the academic communities (Berlin declaration on open access to knowledge in the sciences and humanities, 2003).

OA as a concept refers to unrestricted and unlimited access to published material. Tennant et al. (2016) defined OA to remove "major obstacles to accessing, sharing and re-using the outputs of scholarly research" (p. 4). Additionally, "OA literature is digital, online, free of charge, and free of most copyright and licensing restrictions" (Suber, 2012, p. 4). The BOAI was the first initiative to use "Open Access" as a term and referred to it as free availability [of scholarly content] on the internet, permitting individuals to read, download, edit and distribute. OA material can be used for lawful purposes without financial, legal, or technical barriers. However, OA does not allow commercial use of the material and keeps complete copyright control with the original author emphasizing the importance of preserving the integrity of the material. While the concept of OA allows for free access to intellectual material, it does not mean copyright laws do not apply or fully protect the material. There are several options for authors to protect their OA intellectual work. One of these options is to license their work under Creative Commons (CC) laws. The CC licenses allow the use and redistribution of the material for at least non-commercial purposes at no cost or access rights restrictions, while the author retains the copyright (Björk, 2004).

Although the primary purpose of OA publishing is to enhance access for everyone and achieve more inclusion, there are several distinct approaches to implementing it (Irfanullah, 2021). In the "Gold OA," which is the primary OA approach, publications are only made available from the publishers. The Gold OA is further broken down into "Direct OA," "Delayed," and "Hybrid OA." The Direct OA is when the entire journal is published as open access. This option is estimated to account for 62% of the Gold OA. The Delayed OA is when users pay for accessing the recent research content, as there is an embargo on the new content. This option is estimated to account for 14% of all gold OA. Finally, in the Hybrid OA, the user is provided with the option to pay a subscription-based journal to publish their papers as open access. This option accounts for 24% of all gold OA models (Björk & Solomon, 2012; Laaks et al., 2011; Li et al., 2018). In addition to the Gold OA, the "green OA" approach would allow the authors to make their material available through self-archiving. Self-archiving might be as simple as uploading the paper to the authors' personal website, or it could involve submitting it to an institutional repository.

Since the inception of the OA movement, the scholarly and publishing communities have acknowledged the many advantages of OA publishing and strived to address issues surrounding article processing charges (APC), the compromised research quality, and self-archiving (Mckiernan et al., 2016; Zamponi & Smallegange, 2021). The following subsection discusses some of the pros and cons of OA publishing in more detail.

OA MOTIVATION AND CHALLENGES

While there are many challenges still facing the future of OA, several opportunities and benefits could shape its future. First and foremost, it increases findability, accessibility, and visibility of journal articles, resulting in higher research impact as measured by the number of citations across a wide range of knowledge domains (Björk & Solomo, 2012; Harnad & Brody, 2004; Hitchcock, 2004; Ticea, 2018). For example, a study of OA articles indexed by the Scopus database insinuates that these articles are more likely to be referenced on the English Wikipedia articles than their non-OA counterparts, indicating more research visibility of the research published in OA journals (Teplitskiy & Duede, 2016). Similarly, Li et al. (2018) report that OA journals will improve journals' citation scores by 0.147 on average.

The impact of OA publication on citation rates of scientific papers might vary across different knowledge domains and according to the research objects' granularity (journals vs. articles) (Antelman, 2004; Eysenbach, 2006; Evans & Reimer, 2017; Gargouri et al., 2010; Hajjem et al.., 2006; McCabe & Snyder, 2014). For example, Antelman (2004) found that citation rates for OA articles in mathematics, electrical engineering, political science, and philosophy exceeded those published in non-OA journals by 91%, 51%, 86%, and 45%, respectively. According to Davis et al. (2008), full-text and PDF downloads of OA articles increased by 89% and 42%, respectively. In addition, the number of unique visitors who accessed OA articles had a 23% increase compared to subscription-based papers (Tennant et al., 2016; Veletsianos & Kimmons, 2012). Rowley et al.'s (2017) study found that even though most academics were unsure about the future of OA, they mentioned its potentials for broader circulation of articles as a primary advantage of OA publishing.

Ticea (2018) explains that OA publishing can facilitate the transition to new citation metrics such as (RCR) or Citex, which can capture the impact of individual articles rather than the journal. Another benefit of OA is the reduced publication time. Björk (2103) analyzed 2700 papers published in 135 journals listed in the Scopus citation database. The publication time was considerably faster in OA journals than in their non-OA counterparts. When research resources are competitive and scarce, OA publishing would potentially allow both publishers and funding agencies to save considerable financial resources by reusing shared data and resources (Tennant et al., 2016). Furthermore, most funders are providing increased funding resources and recognition to researchers who openly share their work. Finally, OA publishing will create new opportunities for partnership and collaboration between researchers from various scientific disciplines and career advancement through enhanced access to novel research, data, and software resources (Mckiernan et al., 2016).

Low cost of electronic publishing has enabled scholars and publishers to experiment with new business models (Bjork & Solomon, 2018). For example, the OA business model supports open research with the primary goal of removing paywall barriers for all readers with internet access. However, as much as this model intends to contribute to the public good by providing equitable access to scientific materials, it has imposed further restrictions by publishers and other content managers by passing the cost for long-term preservation of the material onto the author. This means that to have the material published on OA platforms, the authors themselves are responsible for paying the APC. OA journal publishers typically require authors to pay APCs, which are used as a source of revenue for publishers to cover publishing costs and long-term preservation of the open-access platform. Most researchers use their research budgets to cover the cost. However, shrinking research budgets across sciences have resulted in inequality in terms of the researchers' willingness and ability to publish in OA journals. Most authors would not afford to publish their work in an OA journal because of all the cost that is burdened on them, while in

subscription-based publishing, the cost is split between thousands of subscribers. Researchers who use public funding from a funding agency in institutions are encouraged to publish in OA journals. However, even then, there is inconsistency in terms of following the institutional or funders mandates.

Thus, APCs is identified as a major obstacles authors should deal with if they wish to publish in OA journals. The current OA model only works well for authors in particular subject areas and geographical regions (Crotty, 2021). Crotty (2021) emphasizes the need to build a diverse ecosystem of OA models, arguing that APC charges should not be a universal solution. Harris et al. (2021) states that the OA publication's cost has turned into "commercial open access," which is against the direction OA should move. In an effort to make open access more affordable, some publishers are providing cost waivers to authors in certain lower and middle-income countries. However, a recent study reveals that 60% of the participants in the AuthorAID survey have paid the APC cost from their pockets despite the availability of waivers (Nobes & Harris, 2019). Powell explains that this is most likely due to a lack of awareness and understanding of APC waivers, recommending that publishers make sure that researchers are aware of their OA publishing options and discounts to reduce the adverse impact of the cost barriers.

Another major limitation of OA is that it requires sufficient investment in infrastructure. However, the reality is that most developing or underdeveloped countries still lack proper infrastructures, such as electricity issues, lack of access to equipment, and internet connectivity. Thus, this dependency on the infrastructure would cause further disparities and inequities, which contradicts the OA's primary goal of reducing disparities and providing equal access.

Another aspect of OA publishing is to establish policies and guidelines. Such policies and guidelines are necessary for the long-term sustainability of OA models, help the OA ecosystem to remain competitive, more visible, and innovative, especially in non-English-speaking countries (Harris et al., 2021). However, it is predominantly the developed western countries that are involved in the development of the policies. Consequently, developing countries are replicating and applying them without any contextualization. This situation has led to either a lack of policy or a mismatch between the policy and the reality of the policy's context in these countries.

In recent years, the "Open Access Scholarly Publishers Association" was founded to address the existing criticisms and standardize the OA publishing process to set quality standards for OA journals (Bjork & Solomon, 2018). However, criticisms and concerns surrounding the quality of the peer-review process in OA publishing persist (Gilbert, 2009). An argument that reinforces these criticisms is that since OA publishers are dependent on the APCs for income, they might be inclined to lower their standards for accepting scientific papers for publication to compensate for the lack of subscription-based income. Thus, the higher publication rates in OA journals would eventually jeopardize commercial publishers and society and deplete the scientific quality control process (Suber, 2007). In his numerous anti-OA articles, Jeffry Beall claims that OA is an "anti-corporatism" movement that attempts to legitimize pseudoscience publishing and pollute scholarly records with unscientific and unvetted research. He coined the term "predatory open access publishing" to emphasize the role of OA publishing in the emergence of low-quality journals and authors' misconduct. In several of his publications, Beall notes that the OA movement has fostered predatory publishing and describes that charging APCs is a way for such publishers to deceive authors by forging a proper peer-review (e.g., 2016a, 2016b, 2017, 2018).

Beall's characterization of predatory journals and equating OA journals to predatory journals have been criticized in several studies (e.g., Bivens-Tatum, 2014; Crawford, 2014). These studies suggest a lack of consensus regarding a definition for predatory journals, underlining a shared sense of confusion regarding distinguishing predatory journals from legitimate journals among authors (Grudniewicz et

al., 2019). In a recent research study, Krawczyk and Kulczycki (2020) examine the accuracy of Beall's arguments by trying to identify the actual characteristics of OA journals. The results of the study indicate that Beall's approach lacks adequate empirical evidence and focuses more on the overgeneralization of flaws, which has led to unjustified and unnecessary prejudice toward OA.

The reality is that predatory journals and bad publishers do exist regardless of the existence of OA publishing. Predatory OA can be detected and dealt with in the same way as those existing with traditional publishing. While peer review of scholarly work is one way to ensure quality, the real validation comes from other studies by other researchers working on similar topics. OA generally improves access to high-quality research. Providing timely access to recent scientific findings would fasten the validation process and enhance the quality of the generated cumulative knowledge.

THE RISE OF MISINFORMATION

Librarians and publishers have traditionally facilitated access to authoritative, evidence-based knowledge, helping us screen the quality of the information. However, with the onset of the World Wide Web, the internet, and personal computers, the situation has gotten out of their control. Now, every individual can publish and communicate true or false information instantly and globally without objective, rigorous evaluation. Additionally, the design of search engine algorithms has democratized the online evaluation process by allowing billions of individuals to vote (by their clicks) and determine the prominence of the shared content, allowing for the ludicrous and false information to make its way to the top of the searches and overturn the good (Iammarino & O'Rourke, 2018). Throughout this process, most individuals judge the content of the information involving their personal beliefs, prejudices, and biases. This would, in turn, increase the likelihood of accepting conspiracy theories and other fabricated information to explain the phenomena that are hard to understand (Spencer, 2009). Research suggests that most people cannot evaluate the information objectively and critically, making them susceptible to fall for evidence-defying information due to its confirmation bias power, that is, accepting the information aligns best with our biases and beliefs (e.g., Suntwal et al., 2020; Vosoughi et al., 2018). For example, researchers at Stanford's Graduate School of Education researched the middle school, high school, and college students' skills in evaluating online sources of information over a year and found that many students failed to evaluate the credibility of the provided information effectively (Domonoske, 2015; Wineburg, 2016).

We live in a time when the so-called "right to opinions" has become more important than our collective sense of responsibility. This has increased the number of individuals rejecting science and believing conspiracy theories and misinformation. Also, the emergence of social media platforms has made it more convenient than ever to freely express our opinions, thus increasing the impact of, and exposure to, misinformation exponentially. Norman (2021) argues that our constant exposure to evidence-defying ideology, which he calls "mental parasites," damages personal judgment and promotes conspiracy thinking (p. 20). Similarly, Fritz (2009) describes how believing in and accepting conspiracy theories has resulted in the fires of wars, causing fears of other groups (the fear of "us" versus "them"), spreading racist sentiments of white men's superiority, and inspiring the creation of new religions (p. 2). These examples demonstrate the depth and breadth of the problem we face as individuals and society. If soon, the lack of awareness of our biases and our inability and insensitivity to correctly assess information presented to us is not recognized, we would face an ill-informed future. (Domonoske, 2015, Hopf et al., 2019).

Social Media and Misinformation

Social media platforms allow people to share information in real-time. The platforms were initially used to connect family and friends and exchange information and pictures through online posts, chat sessions, and audio and video connections. These platforms' openness and ease of use made them the preferred platforms for communication over traditional communication methods. The smart integration of social media applications with the news and current affairs and notifications enabled people to get instant information and stay better informed. The Global Web Index report (2019) on social media revealed that generation Z spends more time on social media than Millennials. Similarly, Pew Research Survey (2019) shows that around seven in ten adults in the U.S. (71%) use Twitter to get news on the site, making Twitter stand out as a news-focused platform. The success of social media platforms such as Twitter, TIK-Tok, and Instagram could be attributed to the fact that younger generations are more visually oriented, and it is an indication of the fundamental changes in the way information is generated, processed, and used. While efforts are being made to regulate these platforms, somehow, their openness makes them susceptible to manipulating information for various political, ideological, and economic reasons. A study by the MIT lab found that false and manipulated information spread 70% faster on social media than information (Aral et al., 2018).

The ease with which content on social media platforms can be created and shared makes it easy for individuals or groups to infiltrate the conversation and spread false and fake news. This has worsened the misinformation problem. For example, Twitter has been one of the major social media platforms in providing us with information about COVID-19 (Chen et al., 2020). However, the plethora of COVID-19 related misinformation, such as the rise of vaccine hesitancy, has contributed to the worsening of the situation. COVID-19 -related misinformation has also led to fear, inappropriate prescribing, less response to warnings on social distancing, and mistrust in medical advice (Rosenberg et al. 2020). The use of social media platforms by businesses, governmental organizations, and academics is primarily motivated by the need to reach a wider audience through marketing, advertising, and promotion. In addition, the content accumulated on Twitter has been used for policymaking and crisis management (Hughes & Palen, 2014; Shakeri, 2020), which indicates the importance and sensitivity of the content generated or shared on social media sites. Nevertheless, the concerns about the spread of misinformation on social media platforms are real, so much so that Larson (2018), whose paper focuses on analyzing the role of social media in the rise of vaccine hesitancy phenomenon, refers to the platforms as a "global public health threat."

One way to prevent the spread of misinformation is that social media platforms hold themselves accountable for the content they produce, just as traditional publishers do. For example, to reduce exposure to false or fabricated information, Twitter has started removing accounts that provide information that contradicts or denies international and local health authority recommendations after the onset of the COVID-19 pandemic (Gadde & Derella, 2020). In addition, recent research recommends that the approach to fighting the spread of misinformation should be multi-faceted and target both the "supply" through efficient fact-checking and changes to the algorithms and the "consumption" through substantially investing in education, particularly to enhance information literacy in schools and beyond (Ecker, 2022; Lee, 2018; Vraga & Bode, 2017).

Knowledge Validation Landscape

Historically, applying unbiased research methodologies and subjecting new knowledge to peers' criticism have determined knowledge quality and objectivity. Before the invention of journals, researchers primarily shared their research results with a limited number of colleagues and collaborators through informal communications. However, the rise of journals made it possible to make the discoveries available to a broader audience for further scrutiny by incorporating them into their theories or conducting further experiments (Hopf et al., 2019).

In 1991, Harnad, in an article entitled, "Post-Gutenberg Galaxy: The Fourth Evolution in the Means of Production of Knowledge," explains four stages of the scientific communication revolution. According to the book, the first three stages are "language" (natural media), "writing," and "printing press" (unnatural media), and the fourth revolution began with the emergence of the internet and electronic journals. Harnad (1991) describes that the significant "time lag" between submitting a paper to a print journal and its appearance in the literature is not in sync with human thinking mechanisms, which typically require rapid interaction. He hopes that online publishing and journals would reduce the time lag by expediting the feedback rounds and benefit the scientific community by increasing the speed of new knowledge.

Fast forward to 2021; Harnad's wish that online platforms would help enhance the validation process is yet to be seen. Today, we find ourselves in a situation where an authoritative publisher does not necessarily determine the reliability and validity of knowledge. Instead, every individual with access to the internet can contribute to the validation process and produce content. Keyes (2004), in his book, "*The Post-Truth Era: Dishonesty and Deception in Contemporary Life*," criticizes our modern way of publishing and validating knowledge, arguing that it has become so difficult to draw a boundary line between lies and truth, where deception has been a habit in our society. As a result, he introduces a third category of information, which is not precisely the truth nor a lie and refers to it as enhanced truth, neotruth, soft truth, faux truth, and truth lite.

In summary, the emergence of the internet and online platforms such as social media have democratized the knowledge validation process by allowing every citizen to speak truth and untruth, as Keyes (2004) calls it *truth lite*, or contributing to its ranking through their clicks or likes. Unfortunately, this new reality has given rise to the phenomenon of *fake science* or *pseudoscience*, which is undoubtedly not what Harnad (1991) hoped to achieve with transitioning to online journals.

Evidence-based Science Communication and Misinformation

Over three hundred years ago, Addison (1710) quoted the satirist Johnathan Swift's clever remark: "A lie can travel halfway around the world while the truth is still putting on its shoes." (p. 15). The quote would provide us with profound insights into the misinformation situation.

First, it reminds us of the faster speed with which misinformation can travel than the truth. Misinformation, typically, is highly biased and can better align with our preconceived notions and biases, making it more attractive. Pierson (2015), in his editorial article for the Journal of the American Association of Nurse Practitioners, underscores the role of good writing in making misinformation so powerful, stating, "Good writing is seductive. It draws you in and convinces you of the impossible" (p. 413).

The fast circulation of misinformation could be due to two reasons: (1) it is too effortless for biased individuals to pour fake information into online platforms, as it lacks serious scientific inquiry and reasoning, and (2) our over-reliance on our biased judgment to distinguish between the truth and deception,

which in most cases would result in our failure (Friesem, 2018). Unfortunately, the way social media's algorithms have been designed to operate has exacerbated the problem. Roney (2018) reports that social media algorithms have democratized news consumption to end the monopoly of Western media giants by allowing individuals' clicks or likes to count. For example, the number of Facebook comments and likes for the ten most prominent Brazilian newspapers decreased by 32% for 12 months, resulting in Brazil's biggest newspaper, Folha de S Paulo, pulling its content from Facebook as a form of protest.

Additionally, the quote acknowledges that the truth is produced through a lengthy process of rigorous scientific work and validation through peer-review, replication, and citations. As Harnad (1991) reports, it may take several years until the literature responds to an author's contribution. The long-term process of scientific inquiry combined with the limited accessibility to sources of academic knowledge due to the publisher's payment walls has also contributed to creating the fake science situation. Hence, it would seem intuitive to think that the only antidote to the fast-spreading misinformation and fake science would be making sources of evidence-based knowledge so accessible to facilitate the circulation and communication of the truth. The more truthful materials circulate on the Web, the less likely it is for people to be deceived by fake information.

Several research studies suggest that proper communication of scientific findings (consensus) can neutralize the influence of misinformation on the American public's perception, emphasizing the importance of evidence-based science communication in changing public misperceptions and increasing acceptance of scientific facts (Bolsen et al., 2014; Cook & Lewandowsky, 2016; Lewandowsky et al., 2013; Kotcher et al., 2014; Van der Linden et al., 2016). For example, Van der Linden et al. 's (2016) research demonstrates that communicating scientific knowledge on human-caused climate change led to the decreased political polarization of attitude toward the issue. Another research study by Van der Linden et al. (2015) found that medical consensus about vaccine safety positively impacts public attitudes towards the risks of vaccines-autism link. These studies argue that high degrees of scientific consensus can immunize us against the scientific misinformation dilemma.

As OA's primary goal is to improve the status of evidence-based scientific communication, the authors of this chapter strongly argue that OA can be a powerful path forward and towards addressing the widespread dissemination of misinformation. As Van der Linden et al. (2015) correctly summarizes, perceived scientific agreements could affect public responses to misinformation.

Open Access as a Trusted Agent, a Possible Path Forward?

Access to information is considered a fundamental human right. The United Nations Educational, Scientific, and Cultural Organization (UNESCO) declared 28 of September as International Day for Universal Access to Information (United Nations, 2021). Access to information is key to the development and progress of humankind. The COVID-19 pandemic highlighted the importance of having access to timely and accurate information. Even though the digital divide continues to widen between the rich and poor in developing countries and developed countries, we should strive to minimize this gap within and between our communities.

The central tenet of OA is "*science as a public good*" rather than "*science as a commodity*" (Harris, et al., 2021). Thus, with the benefits it offers, OA can play a vital role in solving our societal issues, including the misinformation predicament (Mckiernan et al., 2016). The OA movement came into existence about two decades ago. That has given the scholarly community some time to provide evidence-based information on the benefits of OA publishing.

One of the significant advantages of OA publishing is increased transparency and reliability of scientific information and improved return on investment (Crotty, 2021). This positively affects both the scientist and the public spheres. While the public can easily access open journals to fact-check information obtained online, researchers and authors are set to gain the most by increasing the impact of their research and scholarly work. Piwowar et al. 's (2018) study has shown that the public has benefited from the significant growth of Gold, Bronze, and Hybrid OA articles in the recent decade. The study reports that 47% of the articles available online through the Unpaywall browser extension were published in OA journals.

Increased circulation and research impact (as measured by citation counts) is another benefit of using OA, indicating more enhanced access and circulation of the research articles. A study of 2,000 articles published in Nature Communication reveals that the OA articles get published twice as much as the subscription-based articles on Twitter and Mendeley (Adie, 2014). Similarly, a study of 1,700 OA articles from Nature Communication shows that OA articles received 2.5–4.4 times higher page views than non-OA articles published in the same journal (Wang et al., 2015). Articles published in OA journals can get more media coverage, as they are circulated more on online platforms than their subscription-based counterparts. Research has found a positive correlation between media coverage and the number of citations an article would receive (e.g., Kiernan, 2003). For example, articles covered by the New York Times received up to 73% more citations than those not covered by the medium (Phillips et al., 1991). Several other studies reveal the positive link between OA publishing and citation counts and research impact (Gaulé & Maystre, 2011; Tennant, 2017; Wagner, 2010). For example, Eysenbach (2006a) found that OA articles published in the "Proceedings of the National Academy of Sciences" (PNAS) were twice as likely to be cited within 4–10 months and nearly three times as likely to be cited 10–16 months after their publication than non-OA counterparts published in the same journal. Therefore, OA papers would be more likely to receive attention from the public and scientific communities.

Another advantage of OA publishing is that it operates legally under the CC licenses, enabling the "reuse" of research findings and their underlying data, leading to further transparency. According to the CC, authors can retain their exclusive reuse rights while allowing others to copy, distribute, and make some use of their work non-commercially (Creative Commons, 2017). The CC licenses aim to remove the disparities in accessing intellectual resources and provide equal opportunities for everyone regardless of geography, race, and nationality. This enhanced transparency and accessibility would eventually positively change public attitudes and misperceptions, increase trust in science, and reduce the chance of misusing and manipulating research findings. Crotty's (2021) article corroborates this argument by noting that the transparency of OA publishing is essential for driving public trust and accurate, reproducible knowledge.

The increased spread of misinformation on social media and other platforms poses several questions. Some of these questions include: what makes open access different? Can open access be trusted, and why? To answer these questions, let us look at the main reasons that led to the creation of the OA movement. The main goal of OA is to go back to the original purpose of scholarly publishing, which is to advance science and promote knowledge creation. Knowledge creation is a cumulative process that happens over a long period of time where research results are published, shared, and reused.

For researchers, OA means more citations of their scholarly work, which will increase the impact of their findings. When COVID-19 started, there was a massive rush for scientific information, given the confusing messaging from politicians and health officials. Even though many scientific papers were published about the virus's type, structure, and makeup, most of these publications were published in

scholarly journals that were not freely available to the public. OA provides the public with timely scientific information that can be used to validate or combat misinformation published on social media and other internet platforms that lack peer review and validation. It basically provides users hungry for knowledge faster access to scholarly work to encounter misinformation and conspiracy theories.

The world is moving toward "open science" to achieve more remarkable advancements in science, such as developing vaccines with new mRNA delivery models and the CRISPR and genome editing for finding cures for some deadly diseases. However, the emergence of the internet and social media has changed the landscape of the knowledge validation process, leading to the rise and prevalence of misinformation. This has created barriers to and weakened the impact of scientific advancements by diverging our collective attitudes from the published scientific consensus. The widespread dissemination of misinformation could threaten democracy by spreading dogmatism and biased negative sentiments, deepening the political polarization of different segments of the society. In this regard, Moscovici (1987) explains that misinformation can "Foment upheaval in society, pervert societal values, aggravate crises, promote defeat, and so on." (p. 154).

The authors of this chapter recognize the critical role of the scholarly community in educating and informing citizens and removing barriers to evidence-based science and democracy (Harington, 2012). Earlier, it was explained that OA publishing could be a practical approach and a trusted source for combating misinformation by facilitating the democratization of evidence-based knowledge and changing the public's misconceptions toward critical issues, such as climate change, vaccines, political conspiracies, and more. The authors refer to this state as the *OA-facilitated knowledge democratization* (OAKD). However, achieving this state would require hard work to sustain the OA business models. Before the COVID-19 pandemic began, achieving the OAKD was a far-fetched goal. However, after the pandemic hit hard and scientists were in such a rush to research the virus and develop a vaccine, the world witnessed the OAKD occurring by several subscription-based journals making their content fully available to help control the pandemic. This high level of global collaboration between the scientists and the scholarly communities resulted in the advancement of the vaccine in a short period. Harigton (2021) highlights the role OAKD had in combating misinformation surrounding the vaccine, noting, "there will always be extremists who reject vaccines, but the world has been included."

As noted earlier, a sustained OA business model would be integral to obtaining the OAKD status. Currently, the OA scholarly community is actively working to sustain the next step of the OA evolution. However, this chapter summarizes a few strategies required to facilitate the path to a sustained OA model.

The first and foremost step towards addressing the sustainability issues is to move away from a "one-size-fits-all" approach. Coming up with an ecosystem of models that works for everyone across the board requires involving all stakeholders, disciplines, perspectives, goals, and solutions from across the scholarly communication landscape, addressing weaknesses and challenges, and working on finding common grounds (Hampson et al., 2021; Open Scholarship Initiative, 2020). This means that *equitable participation* in addressing OA sustainability challenges the wider scholarly community faces is paramount (Irfanullah, 2021; Michael et al., 2020). Second, the scholarly community needs input from various stakeholders and transparent standards for enhancing OA publishing, ideally based upon the FAIR principles already in place for scientific data management and stewardship (Crotty, 2012). Third, the scientific community eventually needs a paradigm shift to publications for "eventual public access and utility." Fourth, securing reliable and re-occurring revenues is critical for sustaining the OA models (Michael et al., 2020). However, at the same time, "feasibility" is the most fundamental criterion for securing funding for open initiatives. Thus, publishers need to answer questions, such as how the journal

provides for the inevitably increasing costs of doing business from year to year to sustain their business in the long run (Anderson, 2021). Finally, librarians and educators can play a crucial role in facilitating open-access information. The increased use of open-access textbooks and open access repositories such as the Open Education Resource (OER) are essential steps in the right direction.

CONCLUSION

This chapter discussed OA motivation, opportunities, challenges, credibility, and the controversial issues surrounding its use. The advent of the internet and the development of social media have given rise to misinformation and made it necessary to reexamine current publishing practices. One might argue that truthful information takes too long to get disseminated, and current business models are outdated in the existing publishing model. On the other hand, OA is more flexible and could address some of the issues related to costly access and circulation of scientific material. OA could offer a viable platform for fighting back misinformation by providing unrestricted access and timely information. In explaining why OA would be a promising path moving forward, the chapter reviewed several studies from the field of social psychology claiming that spreading trusted information based on scientific consensus could inoculate the public against the negative influence of misinformation (Cook 2016; Cook et al., 2017; Van der Linden et al. 2015). These studies suggest that individuals regularly use their prior knowledge and beliefs to evaluate the validity of incoming information without critically considering the implications of accepting the misinformation. This allows for biased information aligned with our prior, outdated beliefs to take root in our minds (Fazio, 1995).

Additionally, by contrast, the information inconsistent with old beliefs can still find its way into humans' knowledge structure system. Richter et al. (2009) refer to this system as the *routine epistemic validation process* (p. 554). Thus, developing a larger knowledge structure through more exposure to trustworthy information and integrating new fact-based knowledge can reduce the likelihood that memory-based processes passively accept incoming misinformation (Naumann & Richter, 2000). Most importantly, exposure to rigorous science immunizes our minds against the worst forms of ideological contagion and strengthens our critical thinking, allowing us to spot and remove bad ideas (Norman, 2021, p. 15).

Accordingly, this chapter proposes that OA can act as a trusted agent, increase exposure to scientific consensus, improve public trust in scientific findings, and facilitate achieving the OAKD status. The availability of evidence-based knowledge can help to prevent the public from ingesting and internalizing false information and from developing misconceptions about essential issues such as climate change. The chapter argues that while OA is still facing many challenges, it provides an opportunity to combat misinformation by improving awareness of scientific consensus and critical/analytical thinking abilities (Van der Linden et al., 2016).

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KEY TERMS AND DEFINITIONS

Article Processing Charge (APC): Open Access journal publishers typically require authors to pay APCs, which are used as a source of revenue for publishers to cover publishing costs and long-term preservation of the open-access platform.

Copyright: A legal right created by the law of a country that grants the creator of an original work exclusive rights for its use and distribution.

Creative Commons (CC): According to the CC, authors can retain their exclusive reuse rights while allowing others to copy, distribute, and make some use of their work non-commercially. The CC

licenses aim to remove the disparities in accessing intellectual resources and provide equal opportunities for everyone regardless of geography, race, and nationality.

Debunking: Debunking refers to the intervention methods to correct the influence of misinformation after it took root in people's minds.

Embargo: The restriction of access to the content of a copy of a work for a defined period.

Gold Open Access: The primary open-access approach through which publications are only made available from the publishers. The Gold Open Access is further broken down into Direct, Delayed, and Hybrid Open Access. The Direct Open Access is when the entire journal is published as open access. The Delayed Open Access is when users pay for accessing the recent research content, as there is an embargo on the new content. Finally, in the Hybrid Open Access, the user is provided with the option to pay a subscription-based journal to publish their papers as open access.

Green Open Access: Allows the authors to make their material available through self-archiving.

Institutional Repository: a repository affiliated with a specific institution. In addition to preprints and published works, most allow members of the institution's community to submit other forms of scholarship, such as presentations, working papers, reports, etc. (e.g., UNT's institutional repository: https://library.unt.edu/scholarly-works/).

Misinformation: Refers to false information created accidentally or designed deliberately to be false and poses inevitable cognition and social interaction challenges due to its misleading nature.

Open Access: Aims to facilitate unrestricted and unlimited access to published material.

Open Access Movement: The primary goal of the open access movement is to support the widespread distribution of peer-reviewed electronic journal literature to make it affordable for researchers from developing countries to access high-quality research content.

Open Access Scholarly Publishers Association: This association was founded to address the existing criticisms and standardize the open access publishing process to set quality standards for OA journals.

Open Educational Resources (OER): Teaching, learning and research materials in any medium – digital or otherwise – that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions.

Prebunking: Includes intervention methods to help people recognize and resist subsequently encountered misinformation. Examples include exposure to authoritative information and warnings messages.

Publishing Agreement: A legal contract between publisher and author(s) to publish written material by the author(s).

Self-Archiving: Self-archiving practices might be as simple as uploading the paper to the authors' website, or it could involve submitting it to an institutional repository.

Chapter 12
Impact of Open Access on Library Collections and Collection Development Services:
With a Case Study of OA From the University of Namibia

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ABSTRACT

The growth of open access (OA) journals has been rapid and substantial. While still not the predominant form of journal publishing, OA journals of varying types have impacted the scholarly communication ecosystem in a profound way. Libraries and librarians have been at the front lines of this effort from the beginning, working with researchers, funders, and institutional administrators to bring out substantive change to the unsustainable models of costly dissemination of research. After over 20 years of progress in both the transition from print to online, as well as opening access to read, how have OA resources fit in with academic libraries' collections? Are OA resources currently considered part of a library's collection? If not, will they ever be? More broadly, what has been the impact of the open access movement and OA resources on library collections, the concept of library collections, and the practice of collection development? How has the impact of OA on collections differed between libraries in the Global North vs. the Global South?

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LIBRARY COLLECTIONS AND COLLECTION DEVELOPMENT

Collections

There are many writings on the subject of library collections, but few address the underlying concept. Typical definitions in glossaries and handbooks refer to "accumulations" or "sum" of "materials" "owned" or "provided by" a "library" (ALA Glossary and LibrarySpeak). Based on interviews, Lee found several criteria on which both librarians and faculty converged (Lee, 2000), that is, the library's collection is a *selective* set of resources, the content of which is considered *stable* and (relatively) *permanent*, which are represented in the *catalog*, and the rights with which to access are *managed* by library. The faculty interviewed continued to equate co-location of physical materials within the library facilities, if not the specific buildings, to the library's collections, and did not considered materials held in remote locations or joint repositories as part of *their* library's collection. Indeed, the users did not necessarily associate the online resources to their library because they accessed them through separate listings or their own bookmarks (Lee, 2000).

Based on these criteria of "library collections", how, then, would Open Access fit in? Are OA resources currently considered part of a library's collection? If not, will they ever be? More broadly, what has been the *impact* of the Open Access movement and open access resources on library collections, the concept of library collections, and the practice of collection development? How has the impact of OA on collections differed between libraries in the Global North versus the Global South?

Concepts of Library Collections

Michael Buckland examined the overarching roles and scope of collections, describing library collections as "subsets of changing membership drawn from the broader set of potentially collectible materials in order to achieve the goals of the library by facilitating access by the population they serve," and that the "development of library collections, then, is essentially concerned with the placing in libraries of copies of pre-existing materials. It is, at root, a logistical exercise to improve service" (Buckland, 1989, p. 216).

A key aspect of this concept of collections that is relevant to this chapter is the *placement* of "pre-existing materials" to facilitate access by the library's patrons. This concept goes beyond any discussion of "ownership" and gets to the heart of the *purpose* of the collection. This conceptual understanding of collections could support the inclusion of digital open access materials which are selected based on needs perceived by the librarian. Buckland's use of "pre-existing materials", however, contrasts with the changes to the publishing environment in the last twenty years. As libraries have pushed for true reformation of publishing and scholarly communication, especially towards Platinum or "true" OA, some have inserted themselves earlier into the scholarly communication cycle, hosting open access platforms, essentially *creating* new content. This idea of "flipping" collections will be discussed later in this chapter.

The conception of the collection and its purpose is not only timeless but also universal. Library collections at institutions of higher education serve the same purposes and functions in African nation as in European or American. Ifidon, for example, listed such purposes of African university libraries, notably meeting the academic and research information needs of students and researchers (Ifidon, 1990). Librarians from all parts of the world who have written on collections and collection management issues reference many of the same key concepts and philosophies of collection.

Ownership vs. Access

Traditional understandings or perceptions of library collections have tended to center on availability and "ownership". Only a few of the faculty users that Lee interviewed understood that not all resources were actually "owned" by the library, whereas most librarians understood the nuances of access and ownership. Questions of ownership versus access have been around for decades associated with interlibrary loan and document delivery and full-text periodical databases extending the availability of resources beyond the walls of the library (Ferguson & Kehoe, 1993; Hawbaker & Wagner, 1996). Then came questions regarding the inclusion of Web sites in the collection (Campbell, 2000; Koehler, 1999; Porter & Bayard, 1999), which has extended to open access resources (Beall, 2009; Collins & Walters, 2010; McCollough, 2017; Schmidt & Newsome, 2007). Lee's interviews indicated that faculty *equated* the library's catalog *with* its collection. Yet, there are considerable practicalities regarding the inclusion of OA resources in the catalog, notably the sheer number of titles to manage, the vast range of perceived quality, the lack of adequate and accurate metadata, and the risk of impermanence.

As licensed access to digital content effectively supplanted ownership of such content, such resources as ejournals shifted from being treated as ancillary to core resources, and librarians and libraries began to incorporate the content more directly into the information systems provided for users, most commonly the library catalog. Indeed, inclusion in the catalog is, in and of itself, a common criterion of inclusion in a collection, by both users and librarians, as evidenced by Lee's research, as well as by the criteria for such statistical reporting as the American Libraries survey and the ACRL Academic Libraries Annual Survey which instructs librarians to "…count only those materials that are considered part of your collection…that are cataloged and/or searchable through the library catalog or discovery system," (ACRL Academic Library Trends and Statistics Survey Editorial Board., 2021), or (prior to 2015) "which has been *cataloged, classified, and made ready for use*" (emphasis added) (Phan et al., 2014, p. 47). Thus, it is clear that the catalog represents the library's collection. If it is in the catalog, it is in the collection; conversely, if it is *not* in the catalog, it is *not* considered to be *in* the collection.

Libraries have developed a range of solutions to address resources not outright "owned" or specifically "acquired" but still purposefully provided to patrons. From "union catalogs" of holdings of consortia or otherwise related libraries (Clayton, 1982; Welsh, 1981), progressing to the inclusion of listings of journals from full-text databases (Hawkins, 1999; Hughes & Lee, 1998), through the early days of ejournals (Chrzastowski, 1999) to the inclusion of open access journal listings in e-resource management services (ERMS) (Grogg, 2005), librarians, library staff, and library vendors have developed solutions that range in sophistication and integration with the library search environment. The result is a sort of "E-Resources Access Maturity Model" (Mettler, 2011) of integration solutions. At its lowest level is the "lists of links" to the aggregators' sites where the library's selectivity is of the list itself, leaving it to the user to scour the lists. Additional methods to make it easier for patrons to find and access the resources involve more labor or costs. Most often, these solutions result in greater integration of the resources within the library's own digital environments, to the point that the resources essentially are incorporated into the collection.

Growth of Collections

Libraries have historically been measured by the size of their collections. This was due to the physicality of recorded learning (Dempsey et al., 2014). Libraries in American academic institutions were initially

small and built primarily by donations from alumni. It was only with the adoption of the German university system in the mid- to late-nineteenth century that American academic library collections began to be developed *intentionally* (Johnson, 2005). Since then, the importance of size grew as an indicator of quality.

Collection development of many academic libraries in African countries appear to rely on the same methods as American academic libraries in the mid-nineteenth century, not due to lack of intention but to lack of funds. As late as 2008, the University of Malawi reported as few as 18 paid subscriptions, supplemented with 16 journals exchanged and 98 journals donated (Chaputula & Boadi, 2010). Conversely, the University of Namibia, which in just 25 years grew from a single campus serving just over 2,500 students to serving students of undergraduate and graduate programs in multiple locations. The library's collection of periodicals grew from 2 journal subscriptions in 1994 to access to over 5,700 with the introduction of databases in 2002 to over 24,000 titles in 2018 (Pfohl, 2018).

In the final quarter of the twentieth century, attention was directed to "the serials crisis", the nickname of the problem resulting from the combined forces of relative reduction in library funding and the double-digit increases in journal subscriptions. The first Periodicals Price Index survey, conducted in 1976, found the average price increase for serials purchased through a serials service in the mid-1970's was 8% to 10% (Brown, 1976, p. 1). From 1986 to 1992, this increase averaged about 13% per year (Prabha & Ogden, 1994). Despite the increase in prices, serials holdings among American academic libraries increased during this pre-digital period, with the average number of serial subscriptions increasing from 1,550 in 1981 (Heintze, 1984) to 1,782 in 1992 (Rinderknecht, 1998, p. 24).

For the members of the Academic Research Libraries (ARL), arguably the largest and most well-funded in North America, the median number of current journals fluctuated between 1985 and 1992, around 15,000-16,000, despite an increase in expenditures from around $1.5M to $2.6M. Starting around 1993, the number of current journals decreased as libraries were unable to sustain this level of provision given the increase in costs. From 1993 to 2001, the median number of current journals dropped to 13,682 (Kyrillidou & Young, 2006, p. 10).

The shift in the delivery of serials from print to electronic started in the late 1980's and early 1990's with the introduction of full-text databases using fixed digital media (e.g. magnetic tape, disks, and CD-ROMs) (Hawbaker & Wagner, 1996; Johnson, 2005, p. 13). These extensions of abstract and indexing database allowed libraries to provide instant access to the articles that were indexed, regardless of whether the library had a print subscription. Eventually, libraries included the titles and dates of coverage of the contents of these fixed-media databases into their catalogs (Hawkins 1999), and effectively into their collections. This could partially account for the increase in average serials subscriptions to 2,126 in 2000 (Carey & Williams, 2003).

The advent of online electronic journals provided extended instant access to the *subscription* content as well as the database. Then the "Big Deals" hooked the libraries and their patrons by extending access to non-primary content, often of questionable relevance. The growth in journal holdings in American academic libraries from 2000 to 2006 was even greater than the previous decade, effectively doubling from 2,126 per library to 5,352 (Holton et al., 2008, pp. 8, 25).There is no question that "Big Deals" extend access to serials substantially; the question has always been at what price?

Academic libraries in the Global South benefited more from the development of fixed media full-text databases than from the growth of online ejournals, largely because the technical infrastructure required for the former is more localized (Alemna et al., 2001; Okogwu & Ozioko, 2018; Pfohl, 2018). Stable electricity and minimal computer technology were the only necessary components to deliver content

from CD-ROMS. Delivering access to ejournals requires a web server, a computer network, multiple desktops, and stable internet connectivity, in addition to stable electricity. However, even the full-text databases using physical media required continuous and stable funding to ensure regular updates, and gaps in "holdings" grew along with gaps in holdings of print journal runs. Collection development in regions of unstable economic and political environments, supported largely by development agencies of the Global North (which were inconsistent in their support) has been marked by fits and starts. Among the "survival strategies" that these resourceful librarians utilize for providing access to serials are participation in consortia and collaboratives, global resource sharing, donor-funded subscription initiatives, and complimentary subscriptions (Kanyengo, 2007). The increasing demand for and supply of journal literature, the consolidation of the commercial marketplace, the resulting increase in journal subscription prices, most substantially from commercial publishers, and the complexities of transitioning from print to electronic (and ownership to access) set the stage for a rejection of the status quo.

Collection Development Librarianship

Like most professions, librarianship has undergone substantial specialization (Cox & Corrall, 2013). Collection development, that is, that "thoughtful process of developing a library collection in response to institutional priorities and community or user needs and interests" (Johnson, pg. 1), has developed into its own specialization of librarianship. This specialty involves a set of activities including (but not limited to) assessing the needs and usage patterns of the patrons, evaluating sources of information, selecting specific sources to be made available to the patrons, and assessing the collection's ability to meet these needs (Johnson, 2005). With the exception of archives, the focus of these services has traditionally been on developing collections of resources created from external sources and meant for consumption by the patrons served by the library.

Collection Development in the Global South

Just as the basic concepts of collections do not vary by geographic region, neither do the basic tasks of collection development. For example, a majority of academic libraries in Tanzania indicated that they practiced all of the basic collection development activities: selection, acquisition, preservation, evaluation, de-selection and outreach (Mwilongo et al., 2020). The most key differences in collection development between libraries in the Global North and the Global South are the power differentials between these geopolitical regions, and the economic and political constraints under which they operate. Numerous descriptions of collection development in varying regions dealing with post-colonial economic disruptions describe many of the same methods, but with the added difficulties of declining value of local currencies, dependency on intermittent donations from international aid, and inconsistent and unreliable funding from university budgets (Arkaifie, 1997; Chaputula & Boadi, 2010; Ifidon, 1990; Kanyengo, 2007). Given these extraordinary obstacles, it is not surprising that reports of holdings of libraries in these regions seem anemic when compared with that of the Global North.

Open Access and the open access movement

In order to describe the impact of open access on library collections and collection development activities, it is important to describe the origins, evolution and current state of open access and the Open Access movement from a global perspective.

Origins

The Open Access movement coalesced around the primary goal of making scientific research freely accessible to all. Key interrelated factors included steeply increasing journal subscription prices and decreasing purchasing power of academic libraries. Decreasing support for non-profit publishers was resulting in the consolidation of journal production by corporations, which were gradually consolidating themselves, resulting in rising journal prices. The prices were rising not due to the publishers' costs of *production*, but because of the consolidation of the *supply*.

The catalyst that enabled the OA movement was the Internet, which at that time was a little more than a skeletal set of interconnected networks developed specifically to *share files*. This infrastructure was applied to the concept of scholarly communication, with servers set up for the express purpose of sharing their research outputs in the form of either a journal (with all the associated services of peer review and editing) or an archive of pre-publication versions of articles (retaining the journal services of the print publishers) (Kling, 1999). Because they *could*, these individuals *did*.

Stevan Harnad, an early advocate of this method and primary supporter of one of the former kinds (*Psycholoquy*), posted on an email distribution list "a subversive proposal" to extend these small experiments of scholarly communication to the world:

"It is applicable only to ESOTERIC (non-trade, no-market) scientific and scholarly publication…the author does not and never has expected to SELL the words. The scholarly author wants only to PUBLISH them, that is, to reach the eyes and minds of peers…so they can build on one another's contributions in that cumulative, collaborative enterprise…"

For centuries, it was only out of reluctant necessity that authors of esoteric publications entered into the Faustian bargain of allowing a price-tag to be erected as a barrier between their work and its (tiny) intended readership, for that was the only way they could make their work public at all during the age when paper publication (and its subsequent real expenses) was their only option. (Okerson & O'Donnell, 1995, p. 11)

The email discussion that this "subversive proposal" initiated was extensive and is well covered in Okerson and O'Donnell's compilation. Topics ranged from the technical [using the technology of the day] to the economic [how much of the costs of publishing are related to print versus electronic production?]. There were skeptics, notably from the publishing "side", and some of the questions covered were somewhat prescient to today's situation with open access, notably,

How expensive will they (the other scholarly services of peer review) be? Will we migrate to a new environment, only to find that we have reinvented there all the things that cost so much in the old environment? If so, what will we have gained? (Okerson & O'Donnell 1995).

Evolution of OA

Once it became clear that the technology *could* enable the dissemination of scholarly works with relatively low costs, activity grew to make it happen on a larger scale. Essentially, because they *could*, they *did*. The formal declarations of intent (Budapest, Bethesda, and Berlin) were generated by the researchers themselves to re-create the scholarly communication network based on the relatively simple technological concept of file-sharing.

It should be noted here that the emphasis of OA has traditionally been on both *access to read* and *access to publish*. From the earliest communications and initiatives, it is apparent that there was an assumption of universal and low-cost access to the Internet. In the ideals of the earliest activists, it appears that access to read was *equated with* access to publish. However, the Open Access movement was initiated and has been dominated by the Global North. Little communication was exchanged in the beginnings regarding the limitations of computer networks in the low-income countries, and when discussed, it was possibly considered only a matter of time before such countries would have enough infrastructure to achieve at least a rudimentary file-sharing network.

Although commercial publishers were not substantively involved in the original conceptualization of open access, by 2015 they were the dominant player, at least in terms of articles published, if not in terms of journals (Crawford, 2021, p. 56), and the threat of OA to the commercial publishing market had faded (Aspesi & Luong, 2014). While the no-fee open access journals (varyingly called "gratis", "libre", "Platinum" and "Diamond") have been the most numerous of OA models (Crawford, 2021), the "article processing charges" or APC model (notably PLoS and BioMedCentral) caught the attention of commercial publishers (Schöpfel, 2018, p. 62). By 2010, the combination of Gold OA (replacing pay-to-read with pay-to-publish models) and Green OA (repositories) became the *de facto* OA models (Pinfield, 2015). From the beginning of the OA movement, the APC business model had been considered a key part of the solution to open access, with Steve Harnad proposing that "…the only options for publishers would be to either reduce their (publishers') costs 'to be paid out of advance subsidies (from authors' page charges,…)'" (Okerson & O'Donnell, 1995, p. 12). But even in those earliest of discussions, there were warnings of effectively replacing costs-to-access with costs-to-publish (Okerson & O'Donnell, 1995, p. 5).

Commercial publishers saw the advantage of seeking payments for publishing over subscription payments, primarily because of the deeper pockets of academic institutions and funding organizations (Nkoudou, 2020, p. 29). The use of article processing charges was advocated by some of the larger institutions, notably the Max Planck Society and the University of California System. In 2015, the MPS predicted that "if universities paid APCs for their own faculty publications, open access would be extensive enough to enable the cancelation of all subscriptions" (Schimmer et al., 2015). The next year, however, the UC Libraries' analysis of its own set of subscriptions determined that this model was not sustainable (Mering & Hoeve, 2020).

In response to the mandates, notably the European-based *Plan S*, institutions have been negotiating with commercial publishers "transformative agreements" which substantially and formally shift costs from accessing to publishing. Such agreements, with their limited caps on charges and lack of transparency, are effectively replacing the "serials *subscription* crisis" with a "serials *publishing* crisis" (Hinchliffe, 2020; Mering & Hoeve, 2020). APCs in general and transformative agreements specifically have been criticized heavily for their inequity (Faciolince & Green, 2021; Kamerlin et al., 2021; Meagher, 2021).

Current State of Open Access

The vision of the Open Access movement was and continues to be the removal of barriers to *access* scholarly works. The *goals* of this vision were to

(A)ccelerate research, enrich education, share the learning of the rich with the poor and the poor with the rich, make this literature as useful as it can be, and lay the foundation for uniting humanity in a common intellectual conversation and quest for knowledge. (Budapest Open Access Initiative, 2002).

The vision is well on its way to reality, with now about 18.6 million articles of scientific literature openly available (Piwowar et al., 2018, p. 10), which is about 28% of all articles which are available with document object identifiers (DOIs). What is concerning is that this progress has not brought the result that was anticipated. As predicted by the reaction to Stevan Harnad's "subversive proposal", the costs to academic institutions and libraries are still extraordinarily high (Bosch & Henderson, 2018; Jurchen, 2020). Furthermore, the "learning of the rich with the poor and the poor with the rich" continues to be hampered by colonialistic epistemicide and poor infrastructure (Nkoudou, 2020).

Based on the listings in Cabell's Journalytics (https://noaa.cabells.com/about-journalytics), out of the 6,035 journals listed, only 15% are "traditional", that is, no open access features. The vast majority are "hybrid" (63%), while 12% are Gold OA and 8% are Green. Ulrich's Periodical Directory (https://www.ulrichsweb.com/ulrichsweb/faqs.asp) is considered more comprehensive and historical, retaining information about active and *inactive* titles. As of late December 2021, there are 45,351 active, peer-reviewed journals. Of these, 14,431 (32%) are open access (per inclusion in the DOAJ).

Walt Crawford's latest analysis Gold OA (including no-fee) journals listed in the Directory of Open Access Journals covers trends from 2015 through 2020 (Crawford, 2021, p. 2). During this six-year period, article publication has increased from 10% per year through 2017 to nearly 19% in 2020, and the rate of Gold OA journals involving some kind of publishing fees has similarly increased. By 2020, nearly 70% of DOAJ *journals* required no fees to publish; however, nearly two-thirds of all *articles* published in Gold OA journals involved fees.Not surprisingly, the highest fees were associated with commercial publishers ("The Big 9") and largely in the science, technology, engineering and mathematic fields (STEM) (Crawford, 2021, p. 1).

Of the more than 45,000 active, peer-reviewed journals listed in Ulrich's, only 801 were published in African countries (1.7%). It should be noted that this rate of journal activity has not substantially changed since the early 1990's (Teferra, 1995). Of these journals, about 30% were open access, which is similar to the distribution of OA among *all* journals. Besides the clearly lower productivity of this region, Crawford noted how "traditional publishers are nearly absent" (Crawford, 2021, p. 91), with university and scholarly societies providing the bulk of publishing services.

The distribution by country of institutional repositories and Green OA is little different than of Gold OA. As of December 28, 2021, there were 5,796 OA repositories registered with OpenDOAR. Four countries account for 38% of all repositories: United States, Japan, United Kingdom and German. Just 210 (3.6%) are from countries on the African continent. The bulk of these are located in South Africa (48), Kenya (44), Nigeria (30), and Algeria (20) (OpenDOAR https://v2.sherpa.ac.uk/opendoar/about.html). While this current state may not be surprising, it is no less challenging when trying to rectify the global inequities of scholarly communication. It is clear that there are many more forces at work than a desire for change.

Infrastructures Necessary for Open Access

The requirements for a successful open access ecosystem start with the same infrastructures necessary for a successful information-digital economy, notably robust information communication technology and knowledge infrastructures (Baker, 2009; Nijkamp & Abreu, 2020). In addition, a successful scholarly communication system is specifically necessary for OA (Okune et al., 2021). The catalyst for successful uptake, however, of OA is the reception of the primary audience - the scholars and librarians themselves.

Although substantial and *consistent* funding is necessary, it is not *sufficient* in and of itself. Information communication technology infrastructure includes an entire range of services, from reliable electrical and internet connectivity to modern network servers at the institutional level to the desktops and laptops of the end users on the campuses (at the least) and preferably in their homes (Ajegbomogun, 2007; Uzuegbu & McAlbert, 2012). This applies also to the needs of librarians and library staff for effectively managing electronic resources (Obidike & Mole, 2015). Although costly, this may be the easiest of the requirements to achieve.

The knowledge infrastructure is arguably just as or even more concerning than the technological infrastructure. Geoffrey Bowker describes the factors that were needed for the current knowledge infrastructure, which began with the Enlightenment, as well as those needed for the "new knowledge infrastructures", notably "knowledge brokers" (those who make connections of knowledge and community) and "knowledge transducers" (those who "transform data, knowledge, and practice in one arena and prepare it for effective use in another") (Bowker, 2018, pp. 211–212). This includes "the long-term preservation and conservation of data, of knowledge, and of practices" (Bowker, 2018, p. 217). The problem is not of capability but of capacity and distribution of the development of this knowledge. The "brain drain" of these regions can be reversed, as demonstrated by South Africa (Teixeira da Silva et al., 2019).

The willingness of the stakeholders may be the hardest to address because it is embedded in the psyche of the scholarly community itself (Smith 2019). The initial model proposed was that of self-archiving (aka "Green OA"), given its simplicity to providing access to articles (Harnad et al., 2004; Okerson & O'Donnell, 1995). Even with the success of persuading publishers to allow self-archiving of pre-publications or even post-prints, it was clear that researchers were not completing the circle (Harnad et al., 2008). Efforts to extend OA mandates were expected to bring greater compliance (Xia et al., 2022), but because researchers have gradually been pushed to the sidelines while the new ecosystem is reshaped by "research managers, publishers, information professionals, and politicians," (Schöpfel, 2018, p. 63), compliance with mandates has been modest at best. For example, despite funder and university mandates at the University of Cape Town, only 5% of the researchers were self-archiving by 2017 (Raju et al., 2017, p. 39). In our own field of library and information science, a search of articles published in five major journals published by Taylor & Francis (which provided a substantially liberal self-archiving policy) found that fewer than one-quarter of articles available in Green OA repositories (Emery, 2018).

Reception of OA in the Global South

From its inception, the Open Access movement has generally been dominated by the countries of the Global North. This is not to say that those involved in the movement were not concerned with the needs of those in less developed nations (Schöpfel, 2018). Indeed, the BOAI stressed the need for access to literature "share the learning of the rich with the poor and the poor with the rich," (*Budapest Open Access Initiative*, 2002). This has not always translated well between these regions, particularly with the flow of

information upstream. Recent critical research has shown the light on the origins and evolution of open access exposing neo-colonial aspects or remnants of colonialism through the veil of goodwill (Nkoudou, 2020; Schöpfel, 2018). These factors have resulted in uneven uptake of open access by region, beyond the economic and technological infrastructures that have slowed uptake of electronic resources in general.

The countries of Latin America and South America appear to have made the most concerted, most collaborative, and arguably, the most successful application of collaborative open access among *all* regions, rich or poor. Their governments have enabled consortia to negotiate subscription agreements, which put their academic institutions at a more advantageous stance with the publishers than most Western institutions (Berger, 2021; Minniti et al., 2018).

Other regions, particularly Africa and South Asia, have had more inconsistent and limited success. The most common factors preventing success include unstable politico-economic environments, remnants of colonial higher education systems that have prioritized publication in Western journals over local publication, limited visibility of OA journals from these regions due to limited indexing in the key vetting lists, poor internet connectivity even on the campuses (let alone the faculty and students' domiciles), and limited skills among the library staff to support these initiatives (Bawack & Nkolo, 2018; Jain & Akakandelwa, 2016; Nkoudou, 2020; Raliat & Adenike, 2020; Smith, 2019).

The higher education institutions of African nations were organized based on the models of their colonial rulers and the mindset has resulted in a devaluation of localized knowledge and a prioritization of recognition from Global North (particularly European and North American, but also, to a growing extent, Chinese) publications (Nkoudou, 2020). The "predatory publishers" scandal has further eroded the perception of scholarly works from these regions, even among their very members (Teixeira da Silva et al., 2019).

Those who have studied the inequities of access to the scholarly communication network (currently and in pre-Web times) have advocated for changes that would lead to bolstering their local production (Ifidon, 1990, 1997; Nkoudou, 2020; Raju et al., 2017; Smith, 2019; Teferra, 1995; Teixeira da Silva et al., 2019). Such changes center largely on increased funding (for technical infrastructure and for training), as well as policies leading to greater focus on local publication for solving local problems, greater collaboration between institutions and countries, and even a rejection of Western ideals and epistemologies (Nkoudou, 2020; Raju et al., 2017; Teixeira da Silva et al., 2019).

Summary of Open Access

While the Open Access movement originated to open science in order to solve societal problems, it has been met with skepticism, scholarly criticism, cynicism, and apathy, particularly by the scholars themselves. Members of the Global North, particularly large commercial publishers, have attempted to re-shape the scholarly communications ecosystem in their own image with minimal attention to the needs and concerns of those in the Global South. Some regions, notably Latin America, have been more successful at building their own OA ecosystem, one which has been isolated, however, due largely to the continuing domination of English language. Other regions continue to struggle to provide the technical infrastructure and stable funding necessary for a purely digital communications system. Meanwhile, the academic institutions, governments, and funders of Western-style research maintain their domination through collaboration with commercial publishers on shifting the financial burden from reading to publishing.

IMPACT OF OA ON LIBRARY COLLECTIONS

Impact on Collections

Intuitively, there is little doubt that the Open Access movement has increased the absolute number of scholarly works available to read free of charge. The number of journals being published has been increasing exponentially and steadily at a rate of 4.3% per year (Gu & Blackmore, 2016, p. 703). Academic libraries around the world went from having access to a few hundred or a few thousand print journal subscriptions in the 1990's to tens of thousands of online journals in 2020

Measuring the impact of the Open Access movement on academic library collections and collection development activities presumes that such materials are, could be, and should be considered part of the library's collection. The perception of "library collection" is based largely on "ownership" and "control", neither of which does the library have with OA resources, excepting those which the library publishes itself. At what point, then, do open access resources "belong" in a library's collection? How does inclusion of OA change the meaning of "collection"?

Integrating Open Access into the Collection

There has been a gradual extension of collection boundaries from "ownership" and "control" to "access". The electronic resource management systems (ERMS) have incorporated the major aggregators of open access journals into their knowledgebases. Thus, as the number of OA journals increased, libraries have been able to choose to (or not to) include OA as just another ejournal platform. But just as with union catalogs, librarians have questioned the legitimacy of including not only that which the library does not "own" but that for which there is no control or need for access control. This is analogous to including Web sites in the catalog (Beall, 1997; Porter & Bayard, 1999). While Web-based OPACs and ERMS were solutions to the question of *could* it be done, there remained the question of *should* they be included. Open access journals cross both categories (web site and ejournal) and given the initial ambivalence to including ejournals in catalogs (Chrzastowski, 1999), it is no surprise that there was even greater reluctance to catalog OA journals (Collins & Walters, 2010; Palmer et al., 2009). Perhaps because the ERMS have eased the management process (Schmidt & Newsome, 2007), libraries which use these services have been more consistent in adding OA journals from the aggregators into the catalog and the collection (Collins & Walters, 2010). Basically, libraries which can easily include OA in their catalogs do so.

For the libraries in less-developed regions, however, uptake of ERMS and link resolver services has been more limited for the same reasons for limited uptake of other electronic or digital resources and services: poorly developed technical and knowledge infrastructure, and inconsistent and unreliable funding (Asogwa et al., 2021). Discovery systems (meta-databases of full-text content) have been an alternative solution to enabling access to open access content. The management of discovery systems is less complicated, labor intensive, and costly than ERMS, while still providing to the library's patrons the content of open access journals. This "third way" effectively extends the library's collections, albeit without formally adding the titles to the catalog. When done purposefully and in conjunction with a broader OA strategy, such a solution effectively incorporates open access journals as part of, rather than ancillary to, the library's collections (see case study inset).

Changing the Conception of Collections

When open access resources are included in library collections, how does that change our *conceptions* of collections? David W. Lewis described a "demand-side" model of library collections, in which he predicted a gradual but steady increase of the proportion of OA materials in a collection of between 1% and 3% per year (Lewis, 2004). Morrison predicted that library collections would (should?) shift from a focus on "discrete items", such that the "collection of the future may be a collection of collections of interrelated and/or interlinked items," (Morrison, 2007). Dempsey, et al., 2014 provided their conceptions of the future of collections, describing different models, notably that of a "networked context" of information, "collections grid" of different formats, sourcing and scaling collections across different levels, the "inside-out" collection (to be discussed shortly), and the "evolving scholarly record", such that "…conscious coordination will be needed as stewardship, discovery, and access of the scholarly record are increasingly distributed across multiple stakeholder communities: libraries, publishers, and other service providers," (Dempsey et al., 2014, p. 401). From this, Michael Levine-Clark predicted that for libraries, "the collection will be a *purely intellectual concept* (emphasis added), since the material will be owned and unowned, onsite and offsite, tangible and digital," (Levine-Clark, 2014), fully eliminating the criterion of co-location.

These prognostications involve many more factors than only open access, most notably the shift of all information from physical (print and media) to digital, and the concomitant disaggregation of content from the traditional containers (books and journals), physical or otherwise. These factors, however, go hand-in-hand with the factors that have led to the OA movement itself. The circle is complete. So, what has been the effect of open access (journals, specifically) on academic library collections themselves?

Changes to Library Serials Holdings

The surveys of academic libraries in the United States have not provided a consistent metric of serials holdings for longitudinal comparisons. The two surveys of longest continuation have been those conducted for Association of Research Libraries (ARL) and the survey conducted by or in conjunction with the U.S. National Center for Education Statistics. Both surveys have modified their metrics of serial holdings substantially during the transition from print to electronic.

Until 2007, the ARL survey reported the number of serial subscriptions. For the 2006-2007 survey, the metric changed to serial *titles*, which better reflected "the true scope of the content provided by research libraries," (Kyrillidou & Bland, 2008, p. 6). Six years later, the survey was even more substantially overhauled to address changing focus from inputs and outputs to impacts. Thus, a number of quantitative metrics associated with holdings were eliminated, including the recently revised metric of serial titles (Kyrillidou et al., 2013, p. 5). The difference between these definitions have made longitudinal comparisons impossible. It is, unfortunately, very difficult to measure the growth in serials that libraries have provided during this (amazing) period transitioning from print to electronic to open access. With that said, the data points provided should paint a rather impressionistic picture.

The last measure of current serial *subscriptions* provided by ARL members was for the year 2005-2006, the median for which was 25,967 (Kyrillidou & Young, 2008, p. 33), which was up substantially from the previous year of 22,404. Again, this is likely due to the addition of electronic versions for the same title being counted twice, as well as the initiation of "Big Deals". It is clear to see why this metric was viewed skeptically. The next year, the median number of electronic serial *titles* of ARL university

libraries was 28,006, of which a median of 7,520 titles were counted as "not purchased," (Kyrillidou & Bland, 2008, pp. 30–31). The last year of this metric, 2011-12, out of a median of 55,717 serial titles available electronically, 14,788 were not purchased (freely-available) (Kyrillidou et al., 2013, p. 27). Clearly, ARL university libraries were absorbing open access journals into their collections by 2012.

The surveys conducted under the aegis of the U.S. Department of Education, variously named "HEGIS", "LibGIS", "American Libraries Survey (ALS)" and "IPEDS/ALS", have similarly shifted responsibilities and metrics (Aliyeva et al., 2018, p. AL-1). During the 1990's and early 2000's, libraries reported serial *subscriptions*. This metric was dropped in 2010, and reports of serials holdings were included in the total-volumes metric. Beginning 2016, the survey introduced new metrics of number of serial *titles* in print and in digital formats (reported separately).

At the time that the Open Access movement was originating, the journal holdings of all academic libraries in the United States were far from anemic. From the 2000 Academic Libraries survey, there was an average of 2,126 serial subscriptions (Carey & Williams, 2003, pp. 28, 63). This varied from an average of just over 600 for libraries serving less-than-4-year institutions to over 8,400 for libraries at doctoral institutions. For the highest level of research institutions (Research I & II tiers), the average number of subscriptions was over 23,000. For this survey, "serial subscriptions" were defined as "…the total number of current serials received, including those that are paid and those received without payment", so this would include any open access journals, as long as they were available through the catalog (Carey & Williams, 2003, p. 6). By 2006, the average more than doubled to 5,352, with the average of doctoral institutions shooting to nearly 16,700.

From 2016, libraries have been reporting the number of print and electronic serial *titles* currently made available to their users through their catalog (*ACRL Benchmark*, n.d.). These titles would cover the entire span of historical holdings, digital or print. Comparing titles to subscriptions is like comparing apples to apple pies - they represent different compilations of the same thing. However, we can make some estimates of growth over the last five years.

Using 2016-17 value as a benchmark (average of 64,565 total serial titles), access to serials has grown over 70% to 110,411 titles on average in 2020. The average percentage of serials that were reported as electronic was 58%. The instructions explicitly include open access titles that are accessible "through the library's catalog or discovery system" (ACRL Academic Library Trends and Statistics Survey Editorial Board., 2021, p. 10). Meanwhile, the percent of collection expenditures that were recurring (that is, for subscriptions) increased only slightly (75.6% in 2015 to 80% in 2020), and expenditures for all library collections per FTE student *decreased* from $654 in 2013 to $575 in 2020. Increases in paid subscriptions and "Big Deals" alone could not account for this 40% increase in journals available (*ACRL Benchmark*, n.d.). Open access publications reported by libraries as part of their collections have exploded and have become incorporated into libraries' collections in the United States.

Statistics of library collections in other parts of the world are harder to find (Chiware & Becker, 2015). Data reported here come from reports of studies of individual or small sets of libraries. One of the more extreme examples comes from the University of Malawi, whose access to serials was as low as 127 titles as late as 2005 (Chaputula & Boadi, 2010, p. 145). Access to journals was greatly expanded by the country's participation in the International Network for the Availability of Scientific Publication's Programme for the Enhancement of Research Information (PERI) from 2008 through 2013, but the final evaluation report notes that after the program's funding ended, access to e-resources decreased (Hanley et al., 2012, p. 15). The website for the University of Malawi library (https://www.cc.ac.mw/page/library-resources) indicates that students have access to over 10,700 resources, but it is not clear

how many of these are currently accessible to their students, given the report of the ending of the program. The resources have not been incorporated into their catalog but rather are accessible via links to lists based on provider. Regardless of the continuation of external funding for subscription resources, the University of Malawi students and faculty effectively have gained access to at least the over 17,300 journals available through DOAJ.

The faculty librarians of the Kenneth Dike Library (KDL) for the University of Ibadan in Nigeria have been prolific producers of library and information science research. Publications from the last two decades of the twentieth century indicated that the number of journal subscriptions fluctuated widely during the 1980's from as few as 12 to less than 180 (Ekpenyong, 1993; Ifidon, 1997; Ola & Adeyemi, 2000). Donations from the MacArthur Foundation, active pursuit of discounted or free subscriptions from publishers, and modifications to funding practices to establish a more sustainable budget enabled the Kenneth Dike Library to gain access to full-text databases and online journals (Adeshina, 2021). Currently, the website for the Kenneth Dike Library provides a listing of electronic resources (https://library.ui.edu.ng/departmental-resources/) which includes several open access listings, including DOAJ and African Journals Online (AJOL). It is apparent that the KDL has greatly expanded the number of journal titles available to their students in the last 30 years.

Changes to Serials Expenditures (or Lack, Thereof)

Despite the tremendous gains in the sheer *amount* of scholarly literature now openly available to read, there has been little positive change in the amount of funds expended for serials. Subscription access models continue to dominate libraries' serials holdings, and subscription costs continue to rise (Breeding, 2019). Despite the growing number of OA articles, there continues to be resistance to substantial cancellations of subscription journals.

During the period that the metric was included in their annual surveys (1995-2006), ARL members reported an average of 7.6% annual increase in serials expenditures (Kyrillidou & Young, 2006, p. 10). Based on the last five years of responses to the more broad Academic Libraries Survey, libraries continue to spend about 77.5% of materials expenditures on serials (*ACRL Benchmark*, n.d.).

Although there has been limited but growing investment in open access initiatives and projects, from hosting OA journal platforms to payments of APCs (Finnie & Arthur, 2016), there has been little reallocation of funds to non-serials resources (*ACRL Benchmark*, n.d.). The costs of supporting open access (e.g. managing institutional repositories (and their respective services), running OA journal publishing systems and services, managing the APC transactions, etc.) are added to library budgets, but not necessarily from the serials funds. These costs could increase as more technological solutions are developed to handle the requirements of the myriad of OA models that appear (Breeding, 2019).

The shift from pay-to-read to pay-to-publish results in even greater expenditures on journal publications, although sources of funds vary widely (Levine-Clark, 2018; Shulenberger, 2016). Already there is evidence of "hyperinflation" of APCs in certain subjects, with no evidence that authors (at least, those in the Global North) take such costs into consideration of their selection of journals in which to submit their works (Khoo, 2019).

Finally, there are the services and responsibilities that support OA resources and publishing. These services have generally been *added* to those of the library, with few, if any, services dropped. Rather than *replacing* subscription journals, libraries have effectively *added* the responsibilities for inclusion of OA to their workload.

IMPACT OF OA ON COLLECTION DEVELOPMENT LIBRARIANSHIP

Changes to Collection Development Librarianship

Along with the debates regarding the changing concepts of library collections and even libraries themselves, there has been a corresponding debate on the changes to "collection development librarianship" and librarianship in general. These debates are interrelated and often occur within the same discussions, largely due to the connection of "library" with "collections". That is, a library *is* its collection.

Some have argued that as more titles are made available Open Access, the library's role as broker of information will be eliminated (Levine-Clark, 2014). While journals do represent the largest expenditures for information purchased by libraries, they are not the *only* resource that requires negotiation and acquisition, notably online books, databases, and digitized archives. Such resources require significant labor and technical skills to develop and refine, for which licensing supports. Furthermore, while there is a trend in making access-to-read free of charge, there is a corresponding trend in making access-to-publish even more costly. Librarians have been heavily involved in "transformative agreements" (TAs), which require extensive expertise in negotiating, understanding and implementing (Jurchen, 2020). While there are concerns about the ethical and logistical issues associated with TAs and increasing APCs (Echterling, 2019; Jurchen, 2020), the library as a broker is likely to remain, regardless of the direction of fees.

Other recommendations focus on selectivity or the vetting role of the librarians. As noted by Lee's interviews, many patrons consider the value in the catalog as a filter, providing access to quality and relevant resources. While ERMS have made it easy to include large collections of OA journals from aggregators like DOAJ, librarians have been advised to use the same criteria for selecting traditional resources to the selection of these journals (Canepi et al., 2013).These criteria are considered universal, in that they can (should) be applied to any kind of resource being considered for addition to the collection. Of course, this conflicts with *our* perception of our patrons wanting access to everything from one place. Thus, librarians have been encouraged to apply their expertise in information organization and description to improve the discoverability of these resources.

Discovery and information management are values that libraries and librarians could add, as well. Michael Levine-Clark noted (in 2014) that, "(b)ecause libraries no longer have a monopoly on the provision of access to information, the value that they add to that content is now just as important as the content itself," (Levine-Clark, 2014, p. 430). The values he predicted included developing "strong and deep" special collections of a variety of formats, providing access and support for reference management tools and research workflows, academic analytics tools, discovery, in addition to supporting APCs and financial transfers.

From the beginning of the Open Access movement, librarians have become more involved in the scholarly communication cycle. Given their vested interest in reducing expenditures on a single form of communication (the scholarly journal), libraries started participating more directly through the establishment of institutional repositories, digitized archives, and journal publishing platforms with the intent of providing lower-cost alternatives. No longer relegated to selected stages of scholarly research, librarians now provide services at all stages (Dempsey et al., 2014). Examples of new services include data curation, text and data, consultation on selecting optimal channels for publishing work, providing insight on copyright issues, assistance with brokering publication fees, and even hosting open access platforms themselves (Dempsey et al., 2014; Grabowsky, 2015; Mullen, 2009).

Flipping Collections

With the increased availability of scholarly works from sources outside of the library, librarians have been reconsidering the kinds of collections they should be providing. There have been calls for an increased effort to focus on the local for collections (Dempsey et al., 2014; Levine-Clark, 2014; Morrison, 2007). This shift from "outside-in" to "inside-out" collections have resulted (or could eventually result) in shifts in services and roles of collection development and subject librarians (Dempsey et al., 2014; Levine-Clark, 2014). Such collections include digitization of archives, enhancement of special collections holdings, and increased efforts to ensure perpetual access to the vast arrays of data and information (Gwynn et al., 2019; Morrison, 2007; Turner & Billings, 2019).

Institutional Repositories

Institutional repositories were the direct result of Green Open Access models and OA mandates (Crow, 2002). They were the solution proposed in the BOAI and other early initiatives as a way to work within the (then) current scholarly communications ecosystem. Some early advocates considered Green and Gold OA to be the only solutions necessary to the reading-paywall problem (Harnad et al., 2004). Institutional repositories evolved in response to conflicting factors - notably, lack of participation (despite mandates) while extending the original purpose to highlighting more forms of institutional outputs. Libraries at institutions with at least a modest amount of research activity have invested in resources to support institutional repositories of research outputs for their institutions. This may include participating in a collaborative or joint effort, often hosted by a larger research-intensive institution in the region, although most major institutions host their own.

Supporting an institutional repository usually involves more than hosting the technology or platform. Services associated with this repository may range from simple hosting with minimal support, to full hosting support with automated harvesting of outputs, assisted description and metadata, and consulting on institutional property rights and copyright concerns (Gwynn et al., 2019). Libraries and librarians have been developing roles of assisting with the discovery of the scholarly works, as well. Institutional repositories have led to the development of new librarian specialties, notably the Digital Librarian and the Institutional Repository Manager (Cox & Corrall, 2013).

Like librarianship in general, these services can be universally applied, despite the different trajectories of the development of digital libraries (specifically, institutional repositories) in different geopolitical regions (Bawack & Nkolo, 2018; Minniti et al., 2018; Owusu-Ansah, 2020; Sawant, 2009; Smith, 2019). There has been a growing rejection, however, of the Western conceptions of service and assessment as applied to libraries in general and open access in particular. Scholars within these regions and advocates support meeting local needs using locally-derived methods and solutions (Bawack & Nkolo, 2018; Nkoudou, 2020; Schöpfel, 2018; Teixeira da Silva et al., 2019).

Journal Hosting

Many libraries, particularly larger libraries which are more active in OA efforts, have taken on the problem of increasing access to publish by supporting OA journal platforms. These services may range from providing the hosting platform only to providing support for all aspects of publishing, even with

managing the cash flow of APCs, albeit at the more moderate costs originally envisioned by Stevan Harnad and others (Okerson & O'Donnell, 1995).

The reasons libraries have for hosting OA journals include more fully supporting Open Access initiatives, supporting the dissemination of their constituents' research and scholarly outputs, supporting an emerging or niche field, and extending their role as disseminators of information (rather than traditional publishers who pride themselves as gatekeepers). Many of the journal hosting services provided by librarians and library staff are themselves extensions of those provided for the institutional repositories. There are journal hosting platforms that require technical expertise and support in managing, as well as metadata expertise for enabling the contents to be discoverable. Services more specific to publishing build on skills that have been deployed by librarians and library staff, including article presentation layout and design, and editorial services (Gwynn et al., 2019).

CONCLUSION AND FUTURE DIRECTIONS

Open Access has had disruptive impact on the scholarly communications ecosystem, including library collections and collection management responsibilities. Vast amounts of scholarly literature have become openly available to read. Libraries have incorporated these resources into their collections, providing access to many more journals and substantially more content. Libraries are also providing more services to support open access. The impact, however, has been unevenly felt. Furthermore, in this period of transition, there has not been any substantial shift in expenditures or responsibilities, only *additions* to expenditures and workloads.

Greater Access to Read, not Shifts

The amount of serial literature freely available to read has increased exponentially since the early years of the Open Access movement. Growing from a few journals sharing files on pre-Web networks to the now over 15,000 journals publishing over a million articles per year (Crawford, 2021), this movement has greatly impacted the scholarly communication cycle.

The amount of serial literature available via academic libraries has increased substantially, possibly exponentially. The number of current journal subscriptions offered by American academic libraries through their catalogs effectively doubled between 2000 and 2006. The total number of serial *titles* offered in American academic libraries grew over 70% from 2016 through 2020, with a *decrease* in the serials expenditures per full-time equivalent student (*ACRL Benchmark*, n.d.).

Growth in access to journal literature via libraries in countries in the Global South has been affected by the print-to-electronic transformation, as well as by the Open Access movement. While some regions have greater barriers to the information-digital economy than others (Hilbert 2015), most urban centers in the world have a well-developed technological and knowledge infrastructure (Baker 2009). Some regions have, notably Latin America and Asia, have an OA ecosystem that is well-developed and integrated within that region, but which is considered "inaccessible" to the Global North due to the language barrier. The linguistic domination of English as the *lingua franca* in scholarly communications has stymied the flow of research "from poor to rich" (Minniti et al., 2018). Other regions, specifically the African continent, are more isolated geopolitically and have more inconsistent development of OA initiatives.

Incorporation of open access materials in the libraries of these regions has been hard to measure. While the technological challenges of fully-incorporating OA resources into the libraries' systems are universal, access to the solutions are inequitably distributed (Asogwa et al., 2021; Raliat & Adenike, 2020). Globally, there has also been inconsistent acceptance of open access as a fully-upstanding member of the scholarly communication community, due in part to perceived resistance to open access literature by scholars, lack of awareness of the opportunities, and the damage from the "predatory journals" scandal (both the label and the offending journals themselves) (Czerniewicz & Goodier, 2014; Dalton et al., 2020; Sawant, 2009; Smith, 2019).

When libraries in these regions *do* take up the mantle of Open Access, however, they have been able to bring to their scholars the full scope of serial literature, very often more relevant to the local needs and interests than that published in paywalled journals (Chigbu et al., 2016; Raju et al., 2017; Uzuegbu & McAlbert, 2012; Zharinov, 2020). Furthermore, they are able to participate in the building of their own open access ecosystem through development of robust and interoperable institutional repositories, no-fee or low-fee journals, and providing services to assist their faculty and students with navigating the complexities of scholarly communication in today's world.

Greater Responsibilities, not Shifts

The aphorism, "Free, as in puppies", clearly applies to Open Access. Despite the extraordinary increase in OA literature available, libraries have made no significant *shifts* in funding for serials. They have merely taken on greater responsibilities for inclusion of these resources in our systems, working within the environments and constraints that is our scholarly communications ecosystem. Likewise, libraries have added (to greater and lesser extents) responsibilities for providing services to support the dissemination of the hard work of their own institutions' scholars through technology and education. There have been, again, no major *shifts* in library services, however; they are provided as part of standard liaison or collection responsibilities.

Greater Hope for the Future

Despite facing obstacles and pressures of hyperinflated APCs, dealing with complex transformation agreements, and being pushed to the sidelines by publishers, administrators and funders, libraries are advised to stay in the mix. Our expertise with organizing information can enable greater exchange across global communities. Our success with advocacy could raise awareness of continued inequities of access to both reading and publishing. Our experiences with community outreach could smooth the interface between communities and funders to enable greater participation in the information-digital economy. Our growing skills at negotiation, advocacy, and information sharing could enable the very competition in the marketplace that is advocated by the commercial publishers.

There are further hopes for library collections, as well. By fully incorporating the wealth of information available through openly into their collections, librarians have the opportunity to make clear choices about the value of open access to their patrons.

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APPENDIX

THE INTEGRATION OF OPEN ACCESS JOURNALS IN ACADEMIC LIBRARIES: A CASE STUDY OF THE UNIVERSITY OF NAMIBIA LIBRARY

By Anna Leonard, Katharina Ngandu, and Karen R. Harker

Introduction

The evolution of information and communication technologies, especially the advancement of the internet, have transformed the way science is produced and communicated. This has led to an increase in online publications and an increase in open access publishing of books and journals. Combined with the high subscription cost of subscription electronic resources, these changes have resulted in libraries across the globe to explicitly include open access in their service provision and collection development (Dempsey et al., 2014). Libraries are now being engaged and will continue to support open access initiatives by supporting the publishing of open access books and journals, archiving of open access information resources, and open education resource initiatives, while librarians are serving as advocates for open access to scientific information (Grabowsky, 2017). In addition, libraries are continuously integrating open resources into their collection development and collection assessment, with some libraries replacing high-cost subscription resources with quality open-access information resources (Grabowsky, 2017, Reed & Jahre 2019). This is also the case for most libraries in Africa, where budgets to subscribe to scientific online resources are limited. This case study will provide a status quo of the University of Namibia Libraries' initiatives and approach to open access resources and services integration.

The University of Namibia (UNAM) was established in 1992 two years after independence. The university houses four faculties: the Faculty of Agriculture, Engineering and Natural Sciences; Faculty of Commerce, Management and Law; Faculty of Education and Humanities; Faculty of Health Sciences and Veterinary Medicine. The University has 12 campuses spread across the country with each housing a library that facilitates access to high quality information resources and services. The UNAM Library aligns with the university`s strategic plan and is geared towards supporting the academic and research goals of the university. The overall UNAM Library print collection stands at 180,000, supplemented by subscribed electronic journals, e-book collection and print journals.

Open Access and Collection Development

The university library continues to develop its collection by integrating more open scholarly scientific resources, especially with the economic downturn causing financial resources to be scarce and libraries facing deep budget cuts. The UNAM integration of open access into the library collection is supported by the "Scholarly Communication Policy for the University of Namibia", as well as the library's collection development policy which supports the integration of open access into its collection using the same selection and assessment criteria that are used to integrate other resources (University of Namibia, 2013). The emphasis of the open access resource collection development is on the relevance and quality of the resources to support teaching, learning, research and innovation development at UNAM, as well

as the reputability of the publisher and the resource (UNAM, 2017). This is due to the complex nature of open access and the growing number of potential publishers that are tarnishing the integrity of open access publishing. Although, academics have the right to suggest a specific resource for inclusion in the library collections, the faculty librarians are responsible for conducting a thorough evaluation and making an informed decision on the inclusion and exclusion of the resource. Subject librarians also review course outlines to identify possible relevant, prescribed, and recommended resources for inclusion in the collection.

Because the library does not have an e-resource management system, open-access resources are not included in the library's catalog. However, link resolvers, such as EBSCO link resolver, are used to integrate the open-access resources into the entire library's online collection. This ensures that these OA resources are accessible at the point of need within the discovery system, as well as the abstract and indexing databases. For access at the journal title level, the open access directories, such as the Directory of Open Access Journals (DOAJ) and Directory of Open Access Books (DOAB), are indexed on the library e-resources listing on the website to optimize use. Due to their complexity, hybrid journals are not included in library collections, unless the library subscribes to providing the complete full-text for such a journal. These efforts have enabled discoverability and findability of OA resources for our students and academics.

Finally, open access is also heavily promoted during orientations and training sessions for both students and academics. The use of discovery search tools allows students and researchers to find scientific information without any discrimination of publishing mode: open or subscribed content, which maximizes the use of open access content as well.

Open Access Publishing and Archiving

Open access publishing and archiving is supported and governed by the institutional policy, the "Scholarly Communication Policy for the University of Namibia". The policy provides a mandate that "all UNAM journals shall be published open access free of cost to the author and the user" and directs that UNAM research submit their research raw data and publications for inclusion in the institutional repository (University of Namibia, 2013). The library, as a supporting strategic entity and knowledge management institution, provided expertise in establishing the open access platforms and managing and maintaining the institutional repository. The library provides support to journal editors on how to use the platform, training licensing model, and copyright issues. In addition, the library serves as an advocate for open access through its campaign for open access publishing and by training researchers on copyright to better understand authors' rights in terms of publishing and archiving. While the university Centre for Research Services funds open access publishing for article processing charges, the library onus is on conducting in-depth resource evaluation to validate the reputability of the journal in which the author intends to publish, to avoid the investment of university resources in potential predatory publishing.

Usage of Open Access Collection and Publishing

Although there are no tools to evaluate the actual usage of open access collections, we are convinced that the open access resources are used, especially now during COVID-19 when most students and researchers access the library remotely. An internal collection assessment conducted in 2015 on the use of the library collection analyzed references of academic and student publications found that open ac-

cess resources were mostly used. The use of open access resources can also be observed by the level of open access publishing at the university. There has been a high rate of open access publishing at UNAM for the past five years. The Scopus index database also shows that about 631 out of 1245 publications published during the past 5 years (2017–2021) are open access publications.

Conclusion

In the wake of economic downturn in the country, government funding of the University has been greatly reduced. Hence, each unit of the university has been encouraged to devise innovative means of optimizing their service with limited resources. To be good stewards of institutional resources, information management and provide access to information, the UNAM Library has embrace and taking advantage of the Open Access resources to support the academic community. During the COVID-19 health emergency in the year 2020, UNAM librarians observed that some library patrons were not always aware of the open-access resources available to them; many inquired about access to journal literature which was readily available to them via open access. Additionally, many UNAM scholars continue to express reservations in publishing their research finds in open access journal. Hence, in order for the institution not lagging behind in publishing research work, active participation should be encouraged.

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Section 3

Navigating the Open Access Ecosystem

In light of the evolving current academic and learning environments, this section consists of chapters that explore various publishing models and discuss the challenges and opportunities, including complex relationships between and among various stakeholders in the textbook and publishing industry as well as the library's critical role in navigating these landscapes.

Chapter 13
Best Practices and Navigating the Effects of Open Access Journals in Scholastic Publication

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ABSTRACT

Open access (OA) journals have transformed the academic publication to a different realm, which was unfathomable years ago. The early 1990s witnessed OA journals founded by individual scholars which are now in the hands of major publication players using them as another disruptive business model. The benefits of an OA system outweigh its disadvantages. Growth in accessibility, visibility, citations, and impact on research work are some of the promising outcomes of OA. Though it has been contemplated as an inevitable element in scholastic writing for a long time, there are many misconceptions loaded with open access. The present study aims to navigate into the perceptions of open access journals among researchers intriguing into the fine clauses established in the scholarly publication arena. The chapter also intends to examine the features of major publishing houses in a global perspectives and probe into the best practices of open access from different publishing houses in an effort to enhance the overall capacity of the open access and to create a knowledge-based economy.

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INTRODUCTION

COVID-19 has led to a series of overwhelming set of strains to publishers with the drop in demand for printed text books. However, demand for online learning segment made them got out of that predicament. The Publishing empire is currently at a pivotal moment where digital publishing is taking over the traditional print publication. The publishing houses and universities embarking on this journey of open access would have a competitive advantage of knowledge, cutting edge research and innovation. Placing research results in a public domain encourages dissemination of knowledge and strengthens the research expedition. The principles of transparency and best practices for scholarly publications in Open Access directories is identified and coded as criteria by Open Access Scholarly Publishers' Associations to evaluate the suitability for membership in their OA directories. The best practices are collaboratively established by the organizations comprising 'The Committee of Publication Ethics' (COPE), 'Directory of Open Access Journal' (DOAJ), 'The Open Access Scholarly Publishers Association' and 'The World Association of Medical Editors'.

Directory of Open Access Journals (doaj.org) suggest best practises and transparency to be maintained by publishers for scholarly publishing work. The website being the first landing page for any information insists on detailing the aim and scope without misleading information and separate ISSN number for print and electronic version. This also emphasizes that the website of the journals should clearly inform the reader on following aspects like, type of review process adapted, publication time period, publication charge if any, publication ethics, access, archiving, editorial team details, copyrights and licensing. One practise which is recently introduced by 'Elsevier' publisher is 'open access mirror journals' which share common editorial board, aim, scope and peer review policy where visibility and reachability is the same as parent journal.

The other best practices the Open Access directories abide by is that the OA digital libraries do not recommend the sale of eBooks through their directories. This practice is adopted by JSTOR which prohibits selling eBooks in their platform and obtains authorisation from the publishers who wish to host their book in the JSTOR platform as a legal requirement. This practice is applicable for any gold or green OA titles, or the publisher has been selling the title and now wishes to convert as OA. JSTOR also mandates book-level metadata which enables their system to properly process the file and also ensure students and faculty find the book in their delivery platform.

Significance and Scope of the Study

The progress of the publishing industry has been phenomenal in the last two decades with the emergence of OA business models. Across the globe, although the numbers of publishing houses are mushrooming, the proliferation of journals in comparison with the value and quality of academic publication has always been a matter of discussion in academics. Though the open access publishing industry is established with well written policies, many researchers are ignorant of OA publishing, its worldwide audience and elite visibility and reach of their work. Along with this, many had bitter experiences with predatory publishers as they exploit the OA business model and charge authors huge publishing fees but fake or neglect peer-review and editorial services. This has caused distrust from authors and readers who believe Open Access articles are not peer-reviewed and of poor quality.

An understanding on important features of major publishing houses in a global perspective as they account for fifty percent of open access publishing and the perceptions of open access journals among

researchers intriguing into the fine clauses established in the scholarly publication arena will provide a clear picture of the present scenario. The research paper intends to probe into the best practices of open access from different publishing houses in an effort to enhance the overall capacity of the open access and to create a knowledge-based economy.

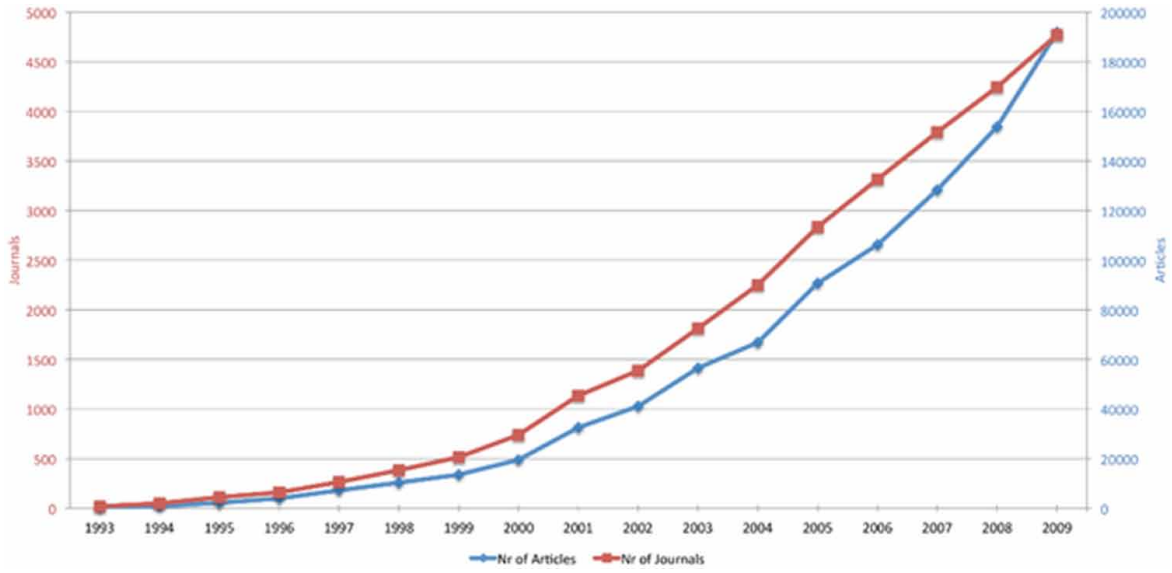
BACKGROUND OF OPEN ACCESS (OA) PUBLISHING

In the mid-20th century, the entire universe faced a big problem known as "serial crisis" which meant the subscription cost of journals were skyrocketing. This price shoot created a difficult situation where the libraries were forced to make choices between journals. Fortunately, the INTERNET was evolving as an attractive factor which changed the total scenario where everyone could publish and share their knowledge if they have an INTERNET connection.

Acknowledging the growing importance of the knowledge dissemination, several discussions on the need for open access has been held, viz., Budapest Open Access Initiative in 2002, the Bethesda Statement on Open Access Publishing in 2003 and the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities of 22 October 2003". These were a few influential initiatives in the establishment of the open access movement (Christian, 2008) occurred in response to restricting the free access of knowledge in the scholarly journals imposing high subscription charges and licence fees. Besides, these initiatives aimed at accelerating the knowledge, enriching the education, sharing the knowledge of the developed countries with the developing and underdeveloped nations and vice versa.

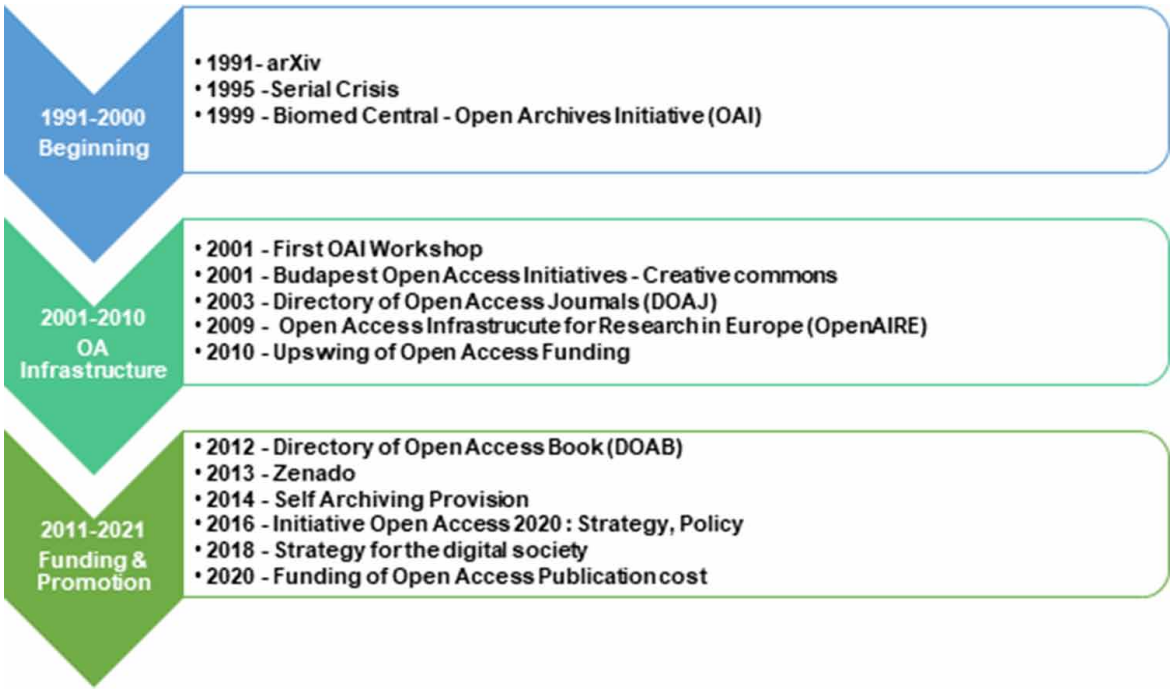
While traditional business models of scholarly journals make their profit from the fees charged to subscribers, open access journals cover their publication cost by charging article processing fees from the submitting authors. The advent of INTERNET services smoothened the way for distribution of e-journals, and across all subject areas, on an average each year, more than 600 journals were added. Figure 1 shows the steady growth of open access publications from 1993 to 2009 at a rate of 30 journals per year (McCabe & Snyder, 2004). A study on contributions of researchers of BRICS countries during the period of 2010-2019, reveal that a total of 2,219,943 papers were published from BRICS countries. The research publications in OAJ from BRICS nations during the year 2010 -2019 shows a modest acceleration in the trend ranging from 13,300 papers in 2010 to 82,310 articles in 2019 (Zia, 2021).

Figure 1. Growth of open access publications from 1993 to 2009
Source: doi: https://doi.org/10.1371/journal.pone.0020961.g002



The following timeline (Figure 2) gives an overview on the history of open access.

Figure 2. Timeline of open access. Source: Author's Depiction



The Open Access Model is available with different variants viz., green, gold, platinum, black and publishers may use one or more options of models. The widely recognised are "gold and green'' open access. The publishers who adopt the Gold OA model make all contents available for immediate access to the public under creative common license (CC) for reprint or reuse. Creative Commons licensing is a public permission opportunity for the users for distributing, remixing, adapting, and building upon the material in any medium or format as permission has already been granted. CC content can be found in the Creative Commons website that lists out number of websites which host CC material. Along with Google, other good resources of CC material include "Europeana", "Flickr", "Open Photo", "Trove", "ccMixter", "Freesound", and "Engagemedia". This type of model is also supported by Article Processing Charge (APC) paid by author or funder. Green Open Access is where authors can self archive their work in their own website or their funder or through independent databases. The articles which come under this model may not be the final one, might be accepted manuscript, post peer review and hence called as "post print". There is no uniformity in governing the accessibility of publication since different publishing houses enforce different embargo periods. The next variant of the model is Hybrid, by the name suggesting it is a mixture of open and closed articles (Laakso & Bjork, 2016). This model is funded by subscriptions and they provide access to paid articles by the author itself. Diamond/Platinum OA is a category where neither author nor reader is charged. So in this case publishing houses will look forward to raising funds through sale of advertisements, academic institutions, government grants (Normand, 2018). In Bronze open access model content is allowed only in the publisher's page and they have full rights to take back the content at any time (e.g. papers on COVID, SAARC) and also permission for reuse or reprint is inhibited in this model. There are also other models like Gratis and Libre where content is free to read but with limited restrictions on reuse.

Benefits of Open Access

The benefits of OA publishing offer a wide range of benefits and are discussed as follows:

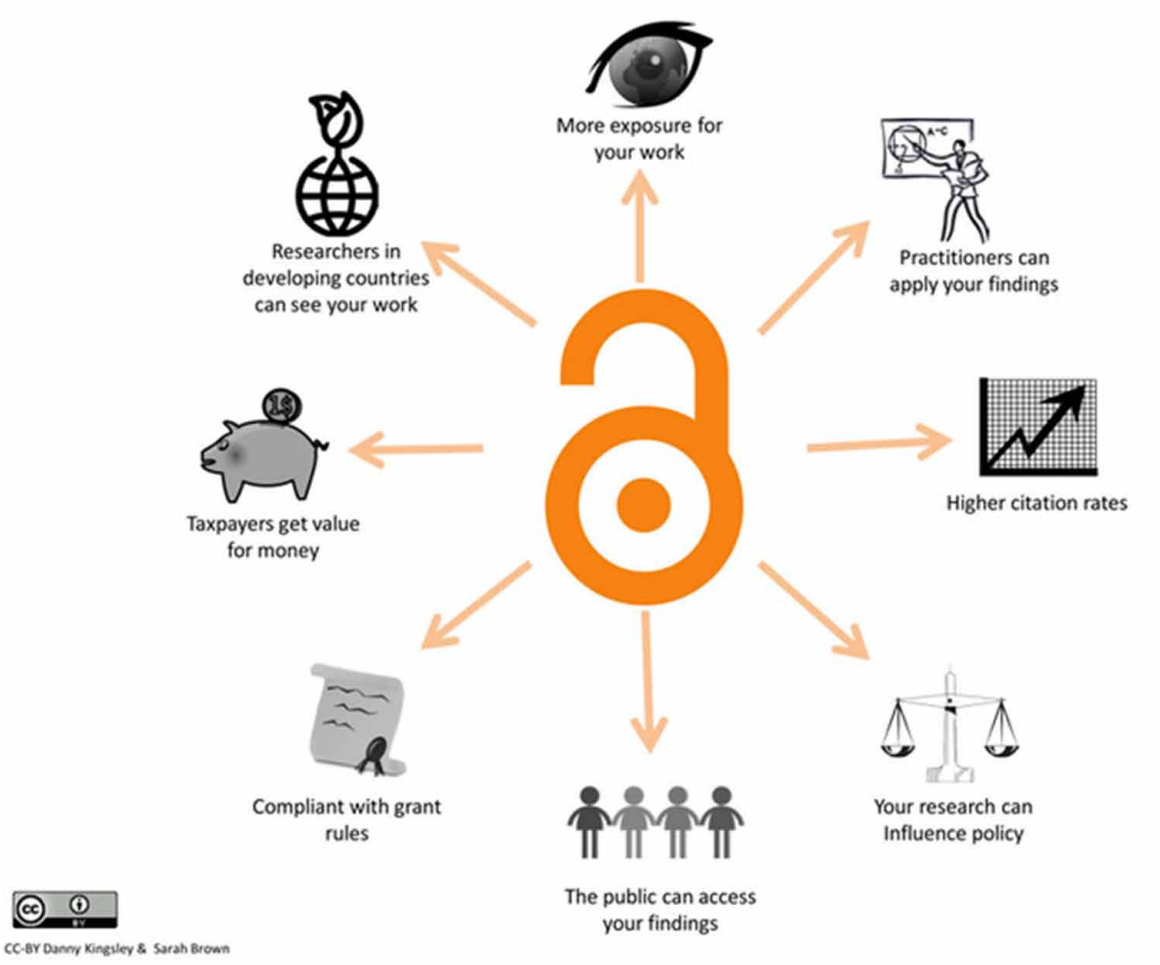
Visibility & Citation: The major advantage of the open access model is it's visibility across the globe and this in fact increases citation and readership. This also gives a new way of collaboration with Policy makers, Government agencies or other funding agencies as the research may also have societal impact.

Increase in reuse of work: As the content is readily available it gives more opportunity for new researchers to build their work based on existing work which ultimately add more value to the published work.

Institutional/ Funder Compliance: Sometime the institutional policy or funding agency may encourage researchers for OA publishing which again yields benefits like collaboration between universities, can disseminate work through institutional repository, increase the indexing and tracking the research output of the institution in all search engines.

Access and Motivational Effect: The benefits of open access give free readership to a huge audience and this brings motivation to researchers of similar line of interest (see Figure 3).

Figure 3. Benefits of open access. Source: Danney Kingsleyand Sarah Brown



Open Access Models

Publishing open access journals requires capital. Same goes for shifting from subscription-based model to open access publishing. The greater amount of research interest on open access in recent years has brought multiple models of publishing. There are few approaches to open access publishing in the market, namely.

1. Transformative agreements
2. Pure Publish agreements
3. Subscribe to open

The most predominant one seen is the 'Transformative Agreement'. A Transformative agreement denotes the agreement between the institutions and the publishing houses which transforms the business model of scholarly publishing. These agreements are based on the understanding that the amount paid

in terms of subscription fees covers the costs of publishing open access journals. These agreements are made either with a library or a library system or a library consortium (Hinchliffe, 2019). Transformative agreements are usually read-and-published and publish-and-read in nature. In a read-and-publish agreement, payment is received both for reading and publishing by the publishing house, where both are bundled as a single contract. In a publish-and-read agreement, payment is received only for publishing. In a library consortium, a publish-and-read agreement would have greater impact on the cost when compared to read-and-publish agreements. These transformative agreements are transitional which are considered to create a sustainable transition model for full open access publishing.

Pure Publish agreements are a contract which is made to handle and fund authors to publish in a full open access journal from a certain publisher. These agreements can take the form of single payment for unlimited publishing or per article-based payments. The read-and-publish type of transformative agreements also carry a component of pure publish agreements. Wiley/DEAL and Springer Nature/DEAL agreements are of this kind. Pure publish agreements with libraries creates new kinds of reports than existing workflow management.

Subscribe to open model focuses on access to the content every time instead of paying for open access publishing. A subscribing library is often guaranteed with access to the content with endless subscription. This model involves no-risk and is an opt-in situation for most libraries. Membership model, the universally followed model, where an individual author pays for the Article Processing charges (APC) works very well for most of the authors as well the publishing houses, however this is not a sustainable solution.

To build and support a diverse ecosystem of open access publishing, new models need to be experimented. But this building of a new model is not an easy task, experimenting a new model, figuring out how to make it happen, and getting approval from the reader community is a herculean task.

Open Access Repositories

Open repositories are created to protect and preserve various kinds of data such as the journal articles reprints, preprints, audio, video, and other digital data. These open access repositories and archives are created by education and research institutions, governments and individual libraries to keep the intellectual outcome of the academicians, researchers and other individuals in specific disciplines (Lamb, 2004). Authors of the research papers are encouraged to deposit their papers before or after publication which is made available to the readers for free. The deposits made can be either institution specific or discipline specific. arXiv physics preprint server in Los Alamos 1991 was the first archive to be created. Directory of Open Access Repositories (OpenDOAR), Registry of Open Access Repositories (ROAR), Open Science Directory, Social Sciences Research Network (SSRN), Directory of Open Access Books (DOAB), Directory of Open Access Journals (DOAJ), OAIster, Connecting Repositories (CORE) are some of the examples of repositories. A statistics report (2020) from OpenDOAR shows that The United States of America (USA) has the highest number (910) of open repositories in the world followed by Japan (682) and the United Kingdom (315). The content language overview shows that English (3693) is the highly used language in the open repositories followed by Spanish (759) and Japanese (539). Interestingly, Multidisciplinary subjects (3362) are the most favored in open repositories followed by Health and Medicine (541); and Science general (373).

Open Access Citation Advantage (OACA)

As Open Access (OA) has become widespread, more and more information is becoming available for researchers. The general opinion among researchers worldwide is that open access articles are cited and read more. Citation metrics are a standard measure of research impact. The number of citations a research article has got shows the validation or recognition the research has got among other researchers. Citations accrue over time (i.e) older articles have more citations than the recent ones. Several studies which have compared citation results of open access articles and non-open-access articles have claimed that open access articles and books get a boost and have much more positive impacts - also called the 'Open Access Citation Advantage (OACA)'. However, this OACA is not universally accepted. There are conclusions from studies that state, OACA is prevalent only among a few subject areas (Basson et.al., 2021). Open access journals with Article processing charges (APC) model have more citation counts than regular open access journals (Ghane et.al., 2020). Citation potential (Sotudeh. 2020), quality and journal reputation, relevance, originality (Ghane et.al., 2020), accessibility and readership are some of the other factors that influence citation counts in open access journals. Based on a close look at the available evidence, a causal relationship was established between citation counts and the OA status in the early studies, however, the recent studies show weaknesses in the methodology used by the earlier studies. Articles using clinicized results, randomized controlled trials and science-based research are cited more often in open access when compared to case reports and general research articles.

Best Practices of Open Access Journals

The OAJ market is growing tremendously and carries a bright spot in the pandemic situation. A market research report (OAJ publishing 2020-2024) from SIMBA, a marketing research firm states that OA journals account for approximately 6 percent of the global scholarly journal and are increasing exponentially at a double-digit rate over the years. Based on the company overview, recent company performance and open access strategy the report lists top players which include both publicly traded and private companies in the OA publishing arena for the year 2020. This section focuses on the leading players and their open access strategy.

Springer Open

Springer Open was launched in June 2010 with Springer's portfolio of 200 plus peer-reviewed fully open access journals across the entire spectrum of science. In August 2012, Springer offered open access books under the Springer Open brand. Authors retain copyrights for their work, licensing them under Creative Common license when they publish in Springer Open. Creative Common Attribution (CC BY) license enables freely downloadable articles from Springer Open website and can be re-used and re-distributed without any restriction when the original work is correctly cited. Springer Open books and journals are freely available online at SpringerLink which is a comprehensive online collection of advanced science index content and listed in the Directory of Open Access Journals (DOAJ) and Directory of Open Access Books (DOAB). Springer Open articles are archived in several international archives immediately after publication. The open access fees cover the cost of the publication process to permit free and instant access to published articles. As part of Springer Open copyright and license agreement, open access

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Elsevier

Elsevier is a Netherland based publishing company founded in 1880. Elsevier is a global publishing business headquartered in Amsterdam. It is one of the leading publishers specialized in science & technology and health information. Elsevier's product and services include print and electronic versions of journals, textbooks, monographs, online citation database, research performance measurement tools and reference works. Elsevier publishes 500,000 plus articles in 2500 journals annually. It has 40000 plus books and over 17 million documents in its archive. The annual download rate of its content surpassed 1 billion marks in the year 2020.

The open access publication is concerned, Elsevier supports both gold and green accesses. Elsevier enables open access publishing to almost all of its 2600 journals in which 500 exclusive open access journals. Publishing open access with Elsevier facilitates 1.5 million viewers of ScienceDirect, one of the leading sources for scientific, technical and medical research. Their gold open access journals are covered by databases such as Scopus, the Directory of Open Access Journals, Web of Science, and PubMed Central. Tracking the visibility of the published article is possible with Elsevier's PlumX Metrics which let the authors to track citations, usage, captures, mentions, and social media activity. Elsevier is associated with ImpactStory, which enables the researchers to ascertain more than 9 million peer-reviewed open access articles in Scopus. The authors are offered a choice between a commercial and non-commercial common license for gold open accesses in their proprietary titles. The published articles are protected by copyright under Elsevier user license. For non-commercial purposes, users may access, copy, download, text, and translate. An user can cite the article with proper citation norms, with the copyright terms and conditions, an user can execute on other users what they can and cannot do. Users need to establish the translation agreements with Elsevier before publishing in it, else they must make a disclaimer about non- establishment of translation agreement. The non-commercial license prohibits the users to copy, download, link to the posting and redistribution of articles for commercial purposes. Furthermore, It prohibits inclusion or incorporation of article content for other works or profit organization's promotion purposes, for monetary rewards by means of sale, resale, license, transfer or any other commercial exploitations.

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The exception is provided only if relevant software is needed to replicate the results of the study that are commercially available to the researchers. Artificial Intelligence review assistant(AIRA) used by the frontiers is competent enough to detect specific types of modifications, manipulations and recycling which lead to rejection of manuscript.

MDPI AG

MDPI has 366 diverse, peer reviewed open access journals in the field of molecular science, public health, drugs, viruses, clinical medicine, environment science, energies, applied sciences and more. Journals published by MDPI are fully open access: research articles, reviews or any other content is available free of cost to everyone. The publication is financed by article processing charges covered by institutions or research funding agencies. MDPI adheres to the International Committee of Medical Journal Editors (ICMJE) guidelines to qualify for authorship of a manuscript. In order to maintain transparency, all submitted manuscripts should contain an author contributorship statement. MDPI is a member of the on Publications Ethics (COPE). It follows rigorous peer-review with strict ethical policies and standards to ensure quality publication works in the field of scholarly publications. MDPI has a zero-tolerance policy on cases of plagiarism, falsifications, inappropriate authorship credit etc. It uses iThenticate software to scrutinize the originality of the article. MDPI has memberships in CASFA, DOAJ, ORCID, STM, Society of Scholarly Publishing, Crossref, UKSG and more. MDPI is also a member of the United Nations Global Compact to support corporate sustainability and committed itself with ten principles of Compact. MDPI does not publish articles funded by the tobacco industry and actively embraces the policy of Diversity, Equality and Inclusion. It has been servicing scholars across the world and diverse backgrounds and creating equal opportunities to people without regard to age, gender, race, colour, sexual orientations, religion, country of origin, socio-economic status or physical ability. The editorial office does check potential conflict of interest with reviewers before they are invited for single- or double-blind review processes. Further, MDPI is committed to research and academic publishing eco-systems. It has association with Sciforum, Preprints, Scilits, JAMS, Proceeding series, Sciprofiles and encyclopaedia. MDPI allows to reuse all of or part of its articles including figures and tables. Reuses of an article does not imply any endorsement by MDPI or authors. MDPi is a RoMEO Green publisher which is a database of publisher's copyright and self-archiving policies hosted by University of Nottingham.

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tend to provide credence to the result which support their own views is known as confirmation bias. The inclination among editors to support new results requires more consideration even though that is not necessary for study context.

Public Library of Science (PLOS) and Cold Spring Harbor Laboratory (CSHL)have been associated to facilitate automatic posting of result articles to PLOS journals on bioRxiv, CSHL's preprint server for life sciences. This partnership enables the authors to share their work on a reliable platform before peer review, accelerating the pace of scientific research. PLOS ONE encourages the authors to submit their study procedure method or protocols for peer review and formal publication in their journal. PLOS permits publishing Lap protocols which are reusable methodologies in all the fields of study and Study protocols which are detailed plans and proposals for research projects that have not yet generated results. Study protocols considered as a single article on PLOS ONE that can be referenced in future papers. PLOS open data policy ensures that other researchers obtain a complete view when they read a PLOS article. It also ensures that publishing authors can publicly display all necessary data and replicate their study findings without any restriction at the time of publications.

Hindawi

Hindawi Publishers are open access, peer-reviewed journals across subject areas such as Biological sciences, Medicine, Physical sciences, Social Sciences and Education and the like. The purpose of Hindawi is to maximize the research impact through openness. Hindawi was founded in 1997 by Ahmed Hindawi and Nagwa Abdel Mottaleb in Cairo, Egypt as a subscription-based business. With huge competition in the publishing industry and to cater to the needs of the company's growth, the company moved to open access publishing in 2007 by establishing partnerships with publishing societies, communities and other publishers like SAGE and Elsevier. The major revenues for this publisher is from the Article processing charges (APC) from authors and institutional membership programs. Hindawi publishers have reduced submission-to-final decision cycle time which encourages a large number of authors to submit research articles. An easy-to-use manuscript submission system, without any formatting requirements; free of charge, full language editing report at point of submission; retention of ownership and copyrights; discount on variety of author services; and post-publication distribution of research are some of the best practices in Hindawi Publishers. Another salient feature is the use of text mining to find articles easily and conversion of files in XML format (Hindawi XML Corpus), where articles can be downloaded by the users as single, full corpus. To support authors from low to middle income countries, the company provides full and partial Article processing charges waiver based on the author's affiliation.

Informa PLC

Informa was formed in 1998 with the merger of IBC group plc and Lloyd's of London Press. Informal PLC encourages open access publishing by bringing in expertise and resources from mergers such as Taylor & Francis, Routledge and Dove Medical Press. Taylor & Francis has launched Taylor & Francis Open which focuses on publishing more than 2000 Open access titles. The group has extended its green access pilot embargo scheme where authors are allowed to post their accepted manuscripts to institutional repositories after publication for greater visibility. Taylor & Francis offers Transformative read-and-publish agreements for the authors from different countries. To improve the robustness in research, Taylor & Francis have begun a number of initiatives such as Open access publishing options, Data sharing policies

and Transparency openness promotion. F1000Research, an innovative open research platform, is used to publish articles rapidly and openly without any cost. Cogent OA, another division of Taylor & Francis Open, is an open access journal focusing on multidisciplinarity that encourages format-free subscription, author copyright retention, high publication standards, and impact metrics. The author services page clearly provides quick links to various information about open access in Taylor & francis and also details the publishing options, licenses, repositories, funding, APC-related information and FAQs. This webpage gives clear guidance to an author looking for open access. Open Science Framework (OSF) is created to build and maintain the researcher workflow. It is a collaborative workspace where researchers share their data and manage research work projects and it includes a registry, data repository and a preprint server. Open science badges (Badging Program) is another best practice followed in Taylor & francis which signals the reader that the content has been made available and certifies its accessibility. These badges should be made visible on the table of contents and implementing these badges must look silly, but they are associated with an increasing rate of data sharing (Kidwell et.al., 2016).

Wolters Kluwer

Wolters Kluwer are global solution providers for software, clinicians, accountants, lawyers, finance, audit and regulatory sectors. They also provide Open Access publishing based on hybrid models for medical journals with the aid of two innovative publishing platforms known as Lippincott and Medknow. Wolters Kluwer ensure best practices of their open access publication happens through faster speed, global distribution, post about recent publications in website and intranets and article deposit in pubmed.

Thieme

Thieme Publishers have been serving medical and science publishers for more than 125 years. The publishers focus on the latest research findings of high quality journals and books. The open access policy of the publisher has a unique practise called “sharing principles” where it encourages the authors to maximize their visibility of work with the help of DOI (Digital Object Identifier). They also encourage open access practises through the “gold and green” open access models. The publishers have best practises like peer-review, professional inhouse editorial, fast publication time and wider access through their electronic journals (https://open.thieme.com/policy).

Table 1. Best practices in open access publishing by leading publishing houses

Publisher	Best Practices in Open Access Publishing
SpringerOpen	1. Fast, reliable, and customized online tools from submission to publication 2. High quality, rigorous peer review and rapid publication 3. Citation tracking and inclusion in bibliographic databases 4. Free and no permission for reprint services 5. Automatic supply of feed to all categories of repositories
Elsevier	1. Lowest Possible Publication charge (APC) 2. State-of-art communication system 3. PlumX metrics to track article's citation, downloading and news 4. Research4Life APC waiver or discount 5. Wider range of publishing options and models
John Wiley & Sons	1. Manuscript transfer program for rapid publication 2. Publicity of quality research and widest possible dissemination 3. Society discount for APCs 4. Active involvement in research data community 5. Uses three Creative Common Licenses
Frontiers	1. Artificial Intelligence review assistant (AIRA) 2. State-of-the-art publishing platform 3. Fee support program for authors no or limited fund available 4. Targeted marketing resulting in high visibility 5. Digital Editorial Office to track journal performance and review pipeline
MDPI AG	1. Effective sources for long-term archiving and copies 2. Author Aid and English editing services prior to publication 3. Think.Check.Submit advise on choosing right articles 4. Quick publication procedure (5-7 weeks: provided no major revision) 5. No embargo period
Public Library of Science	1. Provisional acceptance to eliminate submitting in succession journals 2. Posting directly to the most relevant preprint server 3. Unlimited and timely updates 4. Easy take credit and recognition for authors and reviewers 5. Research work remain replicable for a long-term
Hindawi	1. Reduced submission-to-final decision cycle time 2. Free of charge easy-to-use manuscript submission system 3. Retention of ownership and copyrights 4. Discount on variety of author services 5. Use of Text mining to find articles
Informa PLC	1. Green access pilot embargo scheme 2. Transformative read-and-publish agreements 3. F1000Research - Innovative open research platform 4. Data sharing policies and Transparency openness promotion 5. Open Science Framework - collaborative workspace for researchers 6. Open Science Badges
Wolters Kluwer	1. Fast, speed publications 2. Active information update on website
Thieme	1. Unique practise called "sharing principle"

Perceptions and Misconceptions among Researchers on OAJ

Open access journals have been the subject of much research. Few studies have investigated the perception of open access journals among researchers, its uses and awareness levels. The main inspiration for most of the researchers to publish in open access journals is increased visibility and citation advantage

(Suber, 2006). Sometimes it is also linked with academic reward and professional recognition (Serrano-Vicente et al., 2016). A study conducted using resources from Taylor & Francis Research and Business Intelligence department shows that 71 percent of participants perceive that OA journals offer wider circulation and 55 percent perceive it offers higher visibility. However only 15 percent of participants expressed intention to publish in OAJ (Frass et al., 2013). A study done at UAE showed that the majority of the University faculty members show positive interest and possess good knowledge about OAJ. Also, Female faculty members are more likely to use OAJ than their male counterparts (Kaba & Said, 2015). Similarly, a study published on German public Universities showed that the attitude of researchers on OAJ depends on factors such as age, position, area of research and self-advancement mode. Researchers from biology and life sciences are more engaged with respect to OAJ when compared to researchers from mathematics, physics, economics and statistics (Eger et.al.,2015). In the past years, there has been a growing momentum for uploading research papers on academic platforms such as Academia.edu, Researchgate and the like. A study analysed on the effect of uploading research work on Academia.edu on citations versus not uploading them. The findings indicate that there is a 16 percent rise in citations count for a journal with a medium impact factor after a year (Niyazov et al., 2016). However, the good opinion of OAJ among researchers does not correspond to their usage of OA resources in research activities. Researchers are aware of institutional repository or other OA practices, but they are unsure on how to use it to disseminate their own research (Serrano-Vicente et.al., 2016). A study conducted among Academic librarians in Africa shows that Impact factor, journal reputation, author fee and unstable INTERNET connectivity are major challenges for OA publishing (Majhi et.al., 2018).

On this note, it becomes imperative for scientific communities to understand the importance of OA resources and should disseminate knowledge on how to use OA resources effectively in teaching, learning and research activities. Though COVID-19 has led to a series of overwhelming sets of strains to publishers with the drop in demand for printed text books. However, demand for the online learning segment made them get out of that predicament. The online learning segment of Pearson recorded 32% growth in both digital and subscription services in the third quarter of 2020 (Chappatta, 2020). Cengage and McGraw Hill also reported increases in their digital sales and online revenue. Publication in OAJ plays a significant role for practitioners and faculty members in academia.

Participants strongly perceived OA publishing as a highly individualist matter embedded within a publishing culture emphasizing reputation and rankings. Factors such as visibility, reputation, and impact play the biggest role for the motivation to publish OA. The primary investigation in this research is related to perception and misconceptions among researchers towards open access publishing, article processing charges, the views of authors on perceived benefits of open access publishing, and whether the writers would be interested in knowing more about publication in open access journals.

Methodology of the Study

The study is both exploratory and descriptive in nature and used primary and secondary sources of information for the findings. The first phase of the study explored several variants of open access models, benefits of open access publishing and best practices followed by major publishing houses. The second phase of the study has adopted both qualitative and quantitative methods of data sourcing. Semi structured telephonic interviews were conducted among randomly selected 27 writers, including medical practitioners, management experts and faculty members from various universities. A structured questionnaire has been used to collect the data from researchers of various academic and non- academic

institutions. In order to obtain greater insights from the respondents, Both qualitative and quantitative attributes were included in the questionnaire. The questions were split into different sections under the following dimensions:

1. Demographic data
2. Awareness level of OAJ
3. Level of usage of OAJ
4. Reasons for OAJ Publishing
5. Challenges in opting for OAJ
6. Reasons for publishing with OAJ
7. Institutional support for publishing in OAJ.

Data from 372 respondents were collected using a simple random sampling procedure by sending direct emails to the respondents. The respondents were requested to produce their response on a 5-point Likert scale ranging from strongly disagree (1) to strongly agree (5). The first section of the survey instrument consists of demographic variables such as age, gender, designation, educational qualification, department, research experience, the type of institutes they belong to, frequency of using open access resources and open access policies of institutions. The profile and the responses indicated that the respondents frequently access open access resources. The second section of the questionnaire included 25 items relevant to capture the variables of interest of the study.

Data Quality

The collected responses were screened for missing values, pattern responses and outliers and among them, 29 observations were removed as those respondents indicated that they were not aware about open access publishing and the accepted sample size for the analysis was 343. This indicates that among the respondents, 7.79% of the respondents, do not know about open access publication at all. Subsequently, the remaining responses were examined further for assumptions related to randomness, data independence and normality. The runs test values greater than 0.05 confirmed the randomness and indicated that the selected samples were the true representatives of the population. The Durbin-Watson statistic (1.91) confirmed the data independency among the predictors and the dependent variable.

FINDINGS AND DISCUSSIONS

Figure 4. Perception of respondents on OAJ

Semi-structured telephonic interviews were conducted with twenty-seven researchers between August 2021 and October 2021. Each interview lasted between twenty-five and thirty minutes. All interviews were recorded, transcribed, and open coded according to emergent themes. Figure 4 represents the perception of the respondents on OAJ in a word cloud. The participants were asked questions regarding their knowledge, perception, advantages, disadvantages and influencing factors for their publication in OAJ. Respondents are asked to explain their perception of OAJ in their own words. Easy accessibility, more citations, free of cost, increased visibility to authors were few advantages mentioned by the participants. Doubtful on the peer review system, expensive in terms of article processing charge, and risk of predatory publishing were the few concerns of OAJ.

Of the 343 responses, 68% were completed by men and 32% by women. In general, 28% of the respondents were research scholars who are in the process of completing their doctoral degree within the age bracket of 24-35, 34% of the respondents were assistant professors from the age group of 35–50, 31% were associate professors and 7% came from professors. 92% of the respondents stated that they regularly use OAJ for their research purposes and out of that 65% has publication in OAJ. 59% are aware about their institution's open access policies and repositories and 42% mostly depend on other sources. 74% stated that they have not attended a training program on publishing in OAJ.

The awareness level of the respondents was measured by asking the respondents knowledge on various open access models, the difference between open access and standard subscription-based publication, article processing charges and editorial policies of open access journals. Among the respondents, only 24% are fully aware about the various open access models. 66% stated that they understand the difference

between open access and standard subscription-based publication. 59% of respondents indicated that they are aware about article processing charges and 28% stated that they have knowledge on editorial policies of open access journals. The telephonic interview of teachers from educational institutions affiliated to universities reveal that they heard about OA publication and feel that those are highly expensive for them and few are concerned about predatory journals.

Table 2. T-test to identify the level of awareness of OAJ among researchers

Variable name	N	MEAN	SD	Std. Error	T	Df	Sig	Mean Diff.	95% Confidence Interval of the Difference	
									Lower	Upper
Awareness level	343	2.8610	1.05060	0.05673	-2.450	342	.015	-.13897	-.2505	-.0274
Level of usage	343	3.2974	1.15918	.06259	4.751	342	.000	.29738	.1743	.4205

A one-sample t-test was run to determine whether awareness score among the respondents was different to normal, with a defined awareness score of 3.0. As there were no outliers in the data, as assessed by inspection of a box plot the mean score (2.86± 1.05) was lower than the normal score of 3.0, a statistically significant difference of -0.138 (95% CI, -0.25 to -0.27), $t(342) = -2.450$, $p = 0.015$. Though the respondents are aware about the OAJ, their awareness level on the scope of OAJ is marginal in terms of the various options and advantages offered by OAJ.

Table 3. Independent samples test to identify the difference in perception level

	Gender	N	Mean	Std. Deviation	Std. Error Mean	F	Sig
Awareness Level	Male Female	236 107	2.7712 3.0592	.99901 1.13623	.06503 .10984	3.819	0.025

An independent sample t-test was run to determine whether awareness score among the male and female respondents was different, mean score (2.77 and 3.05) with $p = 0.02$. Since p is less than chosen significance level $\alpha = 0.05$, rejected the null hypothesis, and conclude that the mean value for male and female researchers are significantly different. Therefore, it can be inferred that the average awareness level among female respondents are more in comparison with their male counterparts.

The level usage of OAJ was measured by confirming the frequency of OA publications, downloading of required materials from OAJ and citation rates from OAJ. 14% stated that they publish usually in OAJ. 62% stated that they access open access journals regularly and depend OAJ for downloading the relevant materials for academic purposes. 69% confirmed that they cite from open access journals and OAJ are good sources of reference for them.

A one-sample t-test was run to determine whether the level of usage score among the respondents was different to normal, with a defined LoU score of 3.0. The mean score (3.29± 1.15) was upper than

the normal score of 3.0, a statistically significant difference of -0.29 (95% CI, 0.174 to 0.420), t (342) = 4.751, $p = 0.00$. This indicates the level of usage of OAJ is high among the respondents. The independent sample t test reveals that there is no significant difference in the level of usage in terms of gender. The ANOVA test also revealed that there was no statistically significant difference between the grouping demographic attributes such as designation and educational qualification of respondents.

The reasons for OAJ publishing were measured by confirming the views of respondents on factors such as citation, visibility and easy accessibility of research work. This construct also measured other aspects such as self-archiving, career development, reduced publication delay and networking with authors of the same research interest. 48% stated that they advocate OAJ as it increases the citation and visibility of research work. 66% prefer OAJ as it gives easy accessibility. 46% supported the self-archiving facility and 74% opine that they are willing to choose OAJ for their career development and quick publication. 70% stated that they were able to network with authors of the same research interest.

The perception on OAJ is measured by enquiring the attitude on quality, peer review systems and questions related to article processing charges. 73% believe that open access journals maintain high quality. 27% doubt the peer review system of open access journals. 19% think that it is unethical to pay money for publication and 22% feel that open access publication is expensive for them, 47% opined that high article processing fee are not affordable to them and 36% are willing to pay article processing charges for OAJ publishing.

Challenges in accessing Open access journals are measured by understanding the attitude of respondents on the difficulty level, editorial policies and archiving facility. 72% find difficulty in finding the correct Open access journals for their research publication, 70% stated that the editorial policies are sometimes confusing to them, 36% informed that the improper archiving of some open access journals creates confusion and sometimes it retrieves too much irrelevant information. Very few indicated that they can easily publish in open access journals.

Publication in Open access journals symbolizes a rising and ever-changing area of interest among academicians and research professionals. It is essential for young research professionals who want to establish their research careers, to develop an essential understanding on challenges and benefits of various publishing models. The findings of the study highlight the fact that the awareness level on various OAJ models is at a minimal level among respondents and most of them preferred to attend a session on understanding the facts of OAJ. The overall perception of OAJ is varied with some age, seniority, and designation of faculty authors. Most of the senior faculty members believe that OA publications that charge APC were expensive with lower quality and were very sceptical about the quality in comparison with the subscription-based publications. The perception of OA by various disciplines was the same and consistent across the academic fraternity.

Recent Trends and Future of OA Publishing

The journey of OA publishing from 1991 to till date witnessed remarkable milestones in its momentum. In the year 2017, OA publishing crossed the fifty percent mark and 2018 witnessed many international funders announcing cOAlition S, a movement to ensure the publication of all its grantees' findings as OA, starting 2021. In September 2021, UNESCO supports the launch of the new version of the "The new Global Open Access Portal (GOAP.info)". October 14, 2021, Cambridge University Press and the Council of Australian University Librarians (CAUL) signed a transformative agreement to support Open Access (OA) publishing in Cambridge Journals for 2022." A recent market update estimated that

by 2025, forty-four percent of all journal articles will be available as OA and seventy percent of article views will be of OA articles.

The forthcoming chances of open access publishing appears to be reasonably promising as the breakthrough of COVID-19 pandemic prompted many major publishers to take away the paywalls around scholarly articles. OA publishing progresses the open communication with peers working on similar subjects greatly reduces redundancy and increases efficiency. Along with this, viable funding models facilitate upholding the traditional peer review processes while relieving researchers of the financial burden and helping them research further research and deliver significant advantages and help create a far greater impact when compared to non-OA publications. The momentum of OA publishing is steadily increasing among the researchers and faculty members as, OAJ allowing them to access articles to which their institution may not subscribe. This would naturally accelerate the faculty members learning and research and facilitate quicker results and discoveries. An extreme revolution of OA publishing vogue would be more diamond or platinum level OA publishing, where neither the author nor the institution would have to pay the journal and publishers would receive backing from external sources ranging from advertisements to grants.

CONCLUSION

While several publishing houses have moved to free access to selected articles, there is a possibility of researchers confusing it with open access. Free access has a 6-12 month delay between publication and availability of the manuscript, also, it restricts readers in distribution and reproduction of the work (Sills et.al., 2005). Whereas, OA journals with APC guarantees open access to all and provides copyrights to the author. OA is crucial for researchers for informing the research community about their research outcomes with faster publication and reduced inequities in access. However, inadequate information technology infrastructure, predatory journals, and lack of awareness of OA among researchers could be a serious hindrance for open access publishing. This study may be used for raising awareness of OA among researchers and encouraging them to contribute their research work in OA journals. The findings of this study are useful and meaningful in understanding the comparative status of research across countries, disciplines, journals and institutions.

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Chapter 14
Open Educational Resources: The Future of Learning

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ABSTRACT

Open educational resources (OER) has varying explanations, but its broadest definitions include materials offered freely and openly to use and adapt for teaching, learning, development, and research. An open educational resource must have an open license following the 5Rs: retain (make, own, and control your copy of the content), reuse (use the content as-is), revise (adapt, adjust, modify, improve, or alter the content), remix (combine the original or revised content with other OER to create something new), redistribute (share your copies of the original content, revisions or remixes with others). With such open educational content, one can learn from a growing pool of knowledge for free. In this chapter, the authors present the rationale behind the open educational resources (OER), types of OER, the key players, opportunities, and challenges adopting it, and the future scope.

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INTRODUCTION

Open education's rudiments can be traced back to the 17th-century English coffee houses and even before. By offering a free space to read the pamphlets and other printed matter available, they enabled an open sharing of knowledge. The visitors to the coffee houses thereby had some initiation along the lines of a public sphere where they could access printed content, discuss, debate, and form public opinions. As the culture of mandatory formal education spread to different parts of the world and intensified in the 20th century, free and easy access to knowledge has become an essential subject of discussion.

Open Educational Resources (OER) are online teaching, learning, and research resources released under an intellectual property license available in the public domain or liberated under an open license that allows no-cost access, use, alteration, and redistribution by others with no or minimal restrictions. The license permits free access and repurposing to the users. OER can be a complete course, textbooks, topics, study material, videos, tests, open-source software, or other tools or techniques to support free access to knowledge. The critical discriminator here is the copyright status of an open-access document. It is not considered an OER if it is copyrighted under an all-right reserved copyright license. But if it carries a Creative Commons license or any other open copyright license, it is gratis[1] open access.

The term Open Educational Resources (OER) was first used in 2002 at UNESCO's 2002 Forum on the Impact of Open Courseware for Higher Education in Developing Countries (Open Pedagogy, 2022). Since then, the world has seen a massive shift in globalization, digitalization, and innovation, which is expected to grow exponentially in the future as well. Consequently, the importance of education has also increased, not exclusively regarding a degree but in gathering and implementing knowledge. This development has led to severe inflation in student debts as education prices escalate. Hence, the poor cannot afford such higher education, fine-tuning the cycle of systemic poverty.

Dutta (2014) presents, Open access materials could be classified based on the type of license (Copyright Protected, Creative Commons, Public Domain), nature of the content (Reading Material, Modular Course), type of media content (Text, Audio, Visual), etc. We can infer that each OER must be unique and distinct through this classification, resulting in a diverse network of open-source learning material. Furthermore, numerous platforms are established to teach anyone with internet access, which is the breeding ground for most open educational resources. Not only does this include thriving start-up businesses, like Coursera or Cognitive Classes, but many respected institutions are establishing their presence as an Open Educational Resource. These include Stanford (Stanford Online), MIT (MIT OpenCourseWare), etc.

Amidst the pandemic, individuals embrace such open opportunities to learn or teach something new to the world. The primary evidence (Digicon, 2019) for this claim can be observed through social media applications such as YouTube, Instagram, Facebook, etc. In 2020, YouTube saw a 50% surge in 'beginner' viewers and monthly over two billion active users. Similarly, Instagram saw a 22.9% increase in users during the pandemic. These figures illustrate that open access content is booming around the globe and includes guidance on various activities such as exercise, cooking, drawing, etc.

Nevertheless, accessible resources are highly pertinent to young minds in the classroom and the faculty members. If implemented rightly, OER could be a cost-effective learning tool for students and potentially aid teachers in preparing sustainable course material. However, the integration of such material needs to be carried out effectively and efficiently. Thus, inspired by the UNESCO OER Toolkit Draft, there are approximately eight steps for the ordered execution of accessible resources into the education system. Still, the focal points of the process involve reviewing the validity and reliability of the OER, its admissibility in the curriculum, remixing and filtering the resource to fit the requirements, and evaluating the

success of the material in the lecture. Teachers could also form their digital resources or repositories and make them available through open licensing.

The pandemic has transformed the traditional teaching and learning pedagogy. Many higher education institutions came up with various models to promote and support OER initiatives. The teachers are trained and equipped with state-of-the-art tools and techniques to deliver lectures online. The COVID-19 pandemic has created a new wave in the education field. The teaching and learning fraternity has seen a significant change in the way learners need to be engaged in the learning process. Different tools and techniques have been created and utilized to make classes more interactive and exciting. Many companies came up with various tools to facilitate and help education institutions by providing teacher training and the online lab setup. One of the significant advantages of online learning that has been witnessed during the pandemic is that the trainees can take the experts' guidance from the comfort of their homes. For example, the number of teachers attending the Faculty Development Programmes rolled out by the All-India Council for Technical Education (AICTE) using OER has increased tremendously. It has created a knowledge pool in the thrust areas, such as Artificial Intelligence, Data Science, Image Processing, etc., making a skilled workforce in higher education.

The chapter is divided into VIII sections. The following is the section description; Section-II presents the existing literature in the field of OER. Types of OERs are discussed in Section III, and the Key players in OER are given in Section IV. Section V and VI present the OER content storage and Challenges and Opportunities in OERs Sector. The VII and VIII Section offers the future research direction and concluding remarks.

BACKGROUND

"Open Educational Resources" was devised to facilitate and encourage open, collaborative knowledge production, consumption, and transaction. Educators and content designers conceived this idea to popularize the reusability of digital material. In 2001, the MIT OpenCourseWare project initiated a global Open Educational Resource Movement (Guttenplan, 2010). However, the global movement for OER only began with the First World OER Congress in 2012. It reaffirmed the joint responsibility (UNESCO, 2012) of governments, international organizations, and institutions to promote the distribution of free knowledge and the open licensing of publicly funded content. In the Second World OER Congress (UNESCO, 2018), the 500 delegates from 111 countries adopted the proposed action plan to achieve sustainable development goals on quality and lifelong education on 41 mainstream open-licensed resources.

Depending on the manner of implementation, perspectives on the practicality of Open Educational Resources can differ. Yet, one established benefit of OER is its cost-effectiveness. The 2016 Florida Virtual Campus' Student Textbook and Course Materials Survey (Office of Distance Learning & Student Services, 2016) showed that 66.6% of students did not purchase textbooks due to their cost. Out of this population, the surveyors perceived that this compromise resulted in 37.6% receiving a lousy grade and 19.8% failing. On the other hand, according to the McGreal (McGreal, 2019) study conducted in 2019 on OER Implementation in 13 Higher Education Institutions, a considerable reduction in savings was "the only consensus found." Examples can support this finding- BC Campus Open Textbook Project saved students over $350,000 in its first two years. The UC Davis ChemWiki replaced traditional textbooks to save students $500,000 across four US campuses.

Furthermore, OER engages the students in molding the educational process—a phenomenon known as open pedagogy (Open Pedagogy, 2022). The learners can access customized courses or packaged resources (including textbooks, learning exercises, etc.) and effectively evaluate the productivity of the resources. This system is a great advantage as the number of students providing feedback on the course is extensive and significant discrepancies can be altered.

Some instructors may also benefit from the OER implementation as it saves productive time (otherwise spent on preparing class material) and shifts the focus to customizing resources for best understanding. Moreover, if little time is available to adapt the resources, lecturers can use packaged resources to provide all materials necessary for the class. Contrarily, many teachers find it primarily more time-consuming and challenging to find good, reliable resources and execute any of the 5Rs (**R**etain, **R**euse, **R**evise, **R**emix and **R**edistribute) on it. Teachers need to understand the legality (McGill, 2012) of the resources and their freedom to use them.

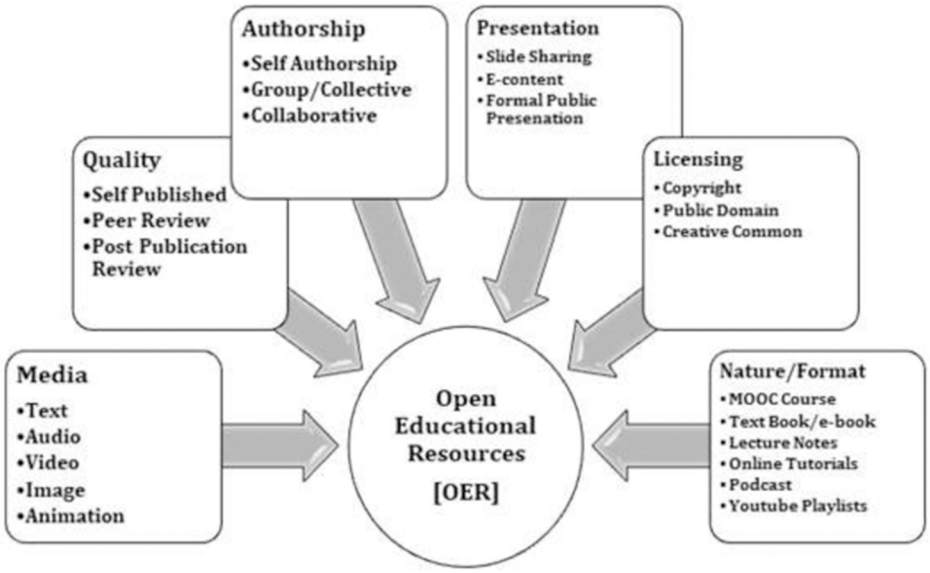
For resource providers, the sustainability of open access material is questionable. Many OER initiatives started as solitary but received funding from various institutions. With the costs of maintaining the resources on expensive servers, there is uncertainty in the permanence of OERs Tennant et al. (2016)

Nonetheless, one cannot dismiss the surge of Open Educational Resources in the last decade, especially during the COVID-19 pandemic. The pandemic has created an atmosphere of economic and social crisis. According to the World Bank (2020), COVID-19 has pushed 88 million people into extreme poverty, making 115 million. In 2021, this number was predicted to rise to 150 million people. Such conditions have rippled into the education sector as well. Not only does remote learning (due to school closures) affect the mental health of students and teachers, but many are compelled to drop their education as the financial situation worsens. As presented in (*24 Million May Drop out of School due to COVID-19 Impact: U.N.* 2020), the United Nations' policy brief on the pandemic's impact on education states that almost 24 million students are at risk for dropping out of school, and 1.6 billion learners have been financially affected by the virus. Open education is essential in forming the supplementary or primary learning mode in financial, physical, and psychological distress. Although many OERs are available electronically, individuals without technological support can also find offline material to continue their education.

TYPES OF OER

Open educational resources (OER) appear in various modes such as text, media, and other digital assets that are publicly accessible and openly licensed. OERs can be used for teaching, learning, assessment, and research. Under specific licenses, the word OER refers to readily viewable resources and materials that anyone can use, modify, enhance, and redistribute (OECD, 2007). The following section explains the classification of OER based on different standards. The chart in Figure 1 below shows the various classification of OER.

Figure 1. Categories of open educational resources



OER Based on Media

Text-based resources, audio or musical resources, video resources, pictorial representations, or even an amalgamation of the media types are all viable examples of OER materials available in the public domain. They could be employed by faculty or students.

Text-Based Resources

The classification of such open-source resources includes E-books (electronic books), eTexts, and e-journals (electronic journals). Some of this Media's most popular digitized repositories are highlighted in the following lines:

- **DOAB (Directory of Open Access Books):** A searchable database of open access books. Over 1,500 academic peer-reviewed books from over 50 publishers are included in this utility. The items that are available under a Creative Commons license can be reused.
- **Open Textbooks by Milne:** This is a modest but expanding library of open access textbooks distributed under the Creative Commons Attribution-NonCommercial-ShareAlike license.
- **HathiTrust Digital Library:** A collaboration of academic and scientific institutions that provides access to millions of works in the public realm.
- **Open Educational Resources Commons (OER):** The portal provides a substantial range of Open Educational Resources for secondary education and college-level programs under a Creative Commons Attribution-Noncommercial license. This is a collection of videos, lesson plans, sound files, and online classes from all over the planet.
- **E-Books & Texts from the Internet Archive:** Over 10,000,000 completely accessible public domain e-books are available in a digital library. Open Library has 300,000 current e-books as well.

- The US National Academies of Sciences, Engineering, and Medicine, the US National Academy of Engineering, the Institute of Medicine, and the US National Research Council have all published publications through the National Academies Press. All the books are free to read, but they are not officially licensed. Reuse of books is not permitted; however, connections to the book's content may be generated.
- **Library of Open Textbooks-** A collection of an extremely high number of books released under a Creative Commons license that allows them to be freely used, altered, and shared. Many of them have undergone peer review.
- **Open Textbooks for Universities and Colleges-**The Open Textbooks for Hong Kong project created this resource. The majority of books have a Creative Commons Attribution-ShareAlike license.

Electronic journals, often known as e-journals or electronic serials by Nelson (2021), are another form of text-based content that, if openly licensed, can be used as Open Educational Resources. E-journals are scholarly journals, or scholarly publications read online. Nowadays, E-journals have become an essential tool for scientific research and advancement. The exponential development in E-journals has led to drastic technological advances in the education industry. E-journals assist professors and students in collaborating more successfully. E-journals also promote learning, scientific and technical research, and the advancement of the innovation process. Today's Open Access journals span a broad spectrum based on the main components of reader rights, reuse rights, copyrights, and more. Given below are some sources for locating e-journals.

- **ScienceDirec**t: ScienceDirect is a prominent full-text scientific database that provides journal articles and book chapters from over 2,500 journals and nearly 20,000 books.
- **BioMed Central (BMC):** BMC features a growing collection of 300 peer-reviewed journals that share discoveries from science, industry, engineering, and healthcare research areas. The face of academic publishing in the late 1990s was revolutionized by making high-quality research available to anybody who required it and making the open-access model sustainable.
- **Public Library of Science (PLOS):** The Public Library of Science (PLOS) was created in 2001 as a non-profit organization with the mission to accelerate scientific and medical development by transforming scholarly communication. They aim to bring researchers together and share their work as quickly and broadly as feasible to improve research and serve society in general.
- **Directory of Open Access Journals (DOAJ):** The DOAJ's goal is to raise the exposure and accessibility of open access scientific and scholarly publications, resulting in higher consumption and impact. The DOAJ wants to be comprehensive, with a quality assurance framework, covering all freely accessible scientific and academic publications. In a nutshell, the DOAJ aims to be a one-stop solution for freely accessible journal users.
- **Elsevier Open Access and Springer Open:** As the demand for open access journals has grown, many established publishers, including Elsevier and Springer, also produce open access journals. Elsevier and Springer have published over 500 peer-reviewed open access journals in numerous fields of science, technology, medicine, the humanities, and the social sciences.
- **OMICS group:** OMICS International is a non-profit organization devoted to making authentic and dependable contributions to the technical community through its Open Access Initiative. The

organization publishes over 300 cutting-edge peer-reviewed Open Access journals and presents over 100 international conferences each year.

OER in Audio Formats

Audio content such as music can also be used as Open Educational Resources. Common tools for locating openly licensed audio are Free Music Archive (free downloadable music) and Internet Archive: Audio Archive (vintage recordings and sound effects). Over 350,000 free music tracks are available for streaming and downloading on Jamendo, a website covered in Creative Commons licenses. Wikimedia Commons is another online library of free-to-use pictures, audio clips-including podcasts- and other media files. Although there are certain restrictions and terms of usage, nearly all content can be easily reused.

Image-Based OER

We may find free high-resolution images (for instance, diagrams, photographs, charts, graphs, and maps) from various sources to use as OER. Some of the standard websites for discovering openly licensed images are discussed below.

- **Creative Commons Search:** Creative Commons Search is a platform for digital material that includes Google Images, Flickr, Europeana, and Wikimedia Commons. It needs to be ensured that before reusing a work, it is available under a Creative Commons license.
- **Europeana:** A single point of access to millions of scanned books, artworks, videos, museum artifacts, and historical information from across Europe. The majority of the materials are in the public realm.
- **Flickr:** Flickr is a common point where users have uploaded millions of photos. The type of license can be chosen from the pull-down menu in" Advanced Search" to find reuse photos (e.g., "Any license," "Creative Commons license," etc.)
- **Google Image (Advance Search**): Many additional filters are available in Google Advanced Image Search to help us to narrow down the search. When we need to narrow down the picture search, Google Advanced Image Search is helpful.
- Apart from these resources, there are many collections, like the New York Public Library Digital Collections, Open Photo, Photos Public Domain, and Pixabayc, containing clipart, images, vector graphics, free stock photos, and illustrations. All images and videos are released free of copyrights under Creative Commons CC0.

Video and Animation based OER

The usage of video-based free educational resources is ubiquitous, with a variety of implementation methods. Students can view videos made freely available on the web from within or outside the classroom, making them perfect for hybrid or online classes. YouTube is one of the most popular platforms to find free educational videos. Subsequently, some well-known scholastic YouTube channels with millions of users are Crash Course, AsapSCIENCE, PBS NOVA, and others.

- **Vimeo:** A video-sharing social site. Vimeo allows users to upload videos that are Creative Commons licensed.
- **TED:** TED is a non-profit organization dedicated to promoting ideas through short, powerful talks (18 minutes or less). TED, which originated in 1984 as a symposium where Technology, Entertainment, and Design collided, has grown to protect almost every topic imaginable, from scientific knowledge to business to international challenges, and is now available in over 100 languages. For instance, **The** TED-Ed branch aims to educate people where all the users have access to various resources available for educators, students, and parents. TEDx events are independently organized to promote the exchange of ideas in communities worldwide. It connects directly to video content from leading experts on a broad array of topics through TED and TED-Ed. The Creative Commons Attribution-Non-Commercial-Non-Derivative license applies to TED talks.
- **FedFlix:** FedFix presents the best videos produced by the United States Government, ranging from instructional films, history, or national parks to the United States Fire Academy and the Postal Inspectors, all of which are free to use.
- **ScienceCinema:** ScienceCinema is a collection of audiovisual videos promoting scientific research conducted by the US Department of Energy. The user can search for specific words or phrases being iterated by the speaker in these video formats using advanced audio indexing and speech recognition technology. A term could be effortlessly typed into the search box, and the outcomes list will precisely show the snippet of the video where the phrase was spoken.
- **Khan Academy:** Videos on Khan Academy generally cover mathematical and scientific matters. There are also lessons in economics and even humanities. Khan Academy videos are licensed under MIT licenses.
- **OER Commons:** This is an inclusive source of Open Educational Resources for high school and college-level programs under a Creative Commons Attribution-NonCommercial license. OER Commons incorporates lesson guides, videos, sound files, and online tutorials worldwide.
- Apart from all the above-said channels or resources, there are Internet Archives for Feature Films, Moving Image Archives, Prelinger Archives, which contain feature films, shorts, silent movies, and trailers. The Moving Image Archives contain various digital moving images, such as fiction and documentary films, advertisements, news footage, television programs, etc., whereas Prelinger Archives contain thousands of movies. It must be assured that only files with a Creative Commons license can be chosen for reuse.

OER BASED ON QUALITY

Self-Published OER

Faculty or online teachers interested in sharing knowledge and experience can create any instructional resource. Such resources that can be used and reused without any monetary obligation are called Self-published OER. Self-published OER materials are not evaluated before publication, so the faculty member who wishes to use or adapt the OER is solely accountable for quality control.

Peer-Reviewed OER

Currently, there are mechanisms to maintain quality control in a domain, especially in academia. Such a procedure to check for the quality of an article or resource is known as peer review. Peer review is a process that evaluates the reliability, integrity, and, in some cases, originality of publications before they are published. A key objective of the peer review process is to protect scientific credibility by eliminating any publications that are either invalid or substandard. Peer review acts as a quality filter for editors, promoting quality publications to state-of-the-art journals. Peer review can sometimes be formal, such as in textbooks and scholarly journals, and unconstrained, to support researchers emerging in open educational resources. Such resources which undergo an evaluation process by peers are known as peer-reviewed. The OER's quality is assessed by peer review based on the following rubrics-

- Accuracy, objectivity, and thoroughness of subject matter.
- Style and presentation should be relevant for the learners' grade, styles of learning, and medium, among other things.
- Pedagogy corresponds to the tasks and evaluations an end-user intends to develop.
- All technical features should be user-friendly so that anyone may utilize them without difficulty.

Thus, peer review helps maintain the quality of the education resource from all ends. Other educators can use an open, post-publication review to help them choose whether to employ an OER with their students.

OERs are frequently misunderstood as low-quality resources. However, individuals who regularly access OER materials consider the easy availability, cost-efficiency as a prominent reason compared to traditional textbooks. The primary goals of OER evaluations can be summarised as:

- Evaluate the quality of open educational resources to utilize them as authentic tools.
- Spread awareness about the current trends and their benefits.
- Assist the users in locating reliable repositories.
- Increase engagement with OERs across diverse academic domains.
- Recommending OER in the curriculum.

OER BASED ON AUTHORSHIP

Open Educational Resources can be categorized based on the contribution made in creating the resources. The resource can be created by an individual or a team of individuals. The following section details the resources based on authorship.

Self-Authorship

Based on the area of expertise, a facilitator prepares and develops the materials or resources for self-authored work. By interpreting topics in one's style and delivering a self-authored resource, one might make substantial contributions to sharing domain knowledge. The author is responsible for a sequence of tasks such as drafting the material, critically revising it to provide important intellectual content, and

gaining the final approval of the version to be published. Furthermore, the content creator appropriately investigates and resolves the work's accuracy and integrity. The presence of evidence of competence and the count of access to the resource by peers enhance the author's expertise and credibility.

Group Authorship

OER materials are also developed and delivered by teams of individuals. This collective approach of creating or repurposing content is referred to as group authorship or joint authorship. Individuals who participate in collective authorship are responsible for selecting co-authors with adequate proficiency and awareness to generate the required curriculum resources. In this approach to authorship, each member is responsible for their section of work, which also pertains to crediting the active co-authors associated. Furthermore, creators also have faith in the integrity of their teams' contributions. For the work to be done successfully, proper planning and making appropriate revisions as needed are required. Group Authorship promotes partnership, facilitates intellectual discussions, and enhances the quality of the openly sourced information.

Collaborative Authorship

Group authorship can lead to Collaborative Authorship when there involves interdisciplinary association to create comprehensive OER. Such collaborative inventions aid in developing resources with expertise in various fields, culminating in sophisticated OER Teixeira (2011).

OER BASED ON PRESENTATION

The method of presentation, such as SlideShare, is another form of OER. The materials might be delivered as e-content, including lecture notes or PowerPoint slides. Another online platform for distributing presentations, slideshows, and condensed documents is SlideShare. SlideShare allows users to post and share content under various Creative Commons licenses.

"Knowledge for Free" is the driving force behind the creation of OER. As a result, formal demonstrations based on various titles are also included in OER can be delivered as seminars, webinars, and workshops. Such sessions are designed to provide opportunities for audiences or recipients to continue learning new concepts and technologies throughout their lives. Moreover, they can help close the gap among non-formal, informal, and formal education and, thus, gain expert knowledge in the domain.

OER BASED ON LICENSING

Licensing is the process of obtaining permission from a published material's original author to apply for that work in an academic setting. A license essentially offers permissions, but it may also include restrictions like determining the feasibility of a resource as OER. An open license, a type of license, allows unrestricted access to re-use and redistribute a subject matter with few or no limitations. With open licenses, creators can retain ownership of their copyrighted work; they are not "giving" away from their copyright.

The open license provides explicit permissions to others to share and modify one's work. It is essential to understand that a work's copyright status will influence what a user can and cannot do with someone else's creative work. Creative works are typically classified into three categories based on their copyright status. Knowing how to recognize and distinguish between different sorts of copyright status can help one to decide which information can be reused and how.

This section covers Copyright, Creative Commons licensing, and reusing publicly licensed work, all of which are useful for academics adopting or creating OER. Figure 2 depicts the three types of licensing and their features.

Figure 2. Types of licensing

Copyright

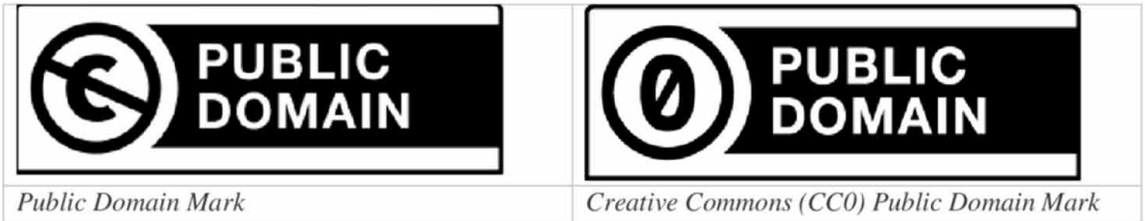
Copyright laws protect authors' rights to their creative efforts (e.g., books, research articles, manuscripts, architectural designs, artwork, video games, video and audio recordings, musical compositions, unpublished creative works) (University of Hawaii, 2018) Copyright is immediately applied to anything "fixed in a tangible medium of expression." The creator(s) of entirely copyrighted works, also known as All Rights Reserved (ARR), owns the worker's rights. It is illegal to utilize others' copyrighted works without its author's consent, and no rights are given in ARR works. Unless the creator grants legal authorization, practices such as duplicating, changing, publicly presenting, publicly executing, and disseminating copies of ARR work may be prohibited. The critical discriminator here is the copyright status of an open-access document. It is not considered an OER if it is copyrighted under an all-right reserved copyright license. But if it carries a Creative Commons license or any other open copyright license, it is gratis open access. The following symbol © is used for the most copyrighted document.

Public Domain (PD)

Data under the public domain is freely accessible for any purpose without the requirement of citing the author or creator, with a few exceptions, such as the inability to claim the PD work of others as one's

own. The work in the public domain can be used with confidence because the licensing has expired or the works were produced by approved agencies and thus entered in the PD after creation or publication. Creative Commons, an organization, devised the CC0 legal mechanism to let authors get their works as close to the public realm as possible by waiving all its rights. Below are the marks for the public domain and Creative Common public domain.

Figure 3. Symbols of public domain and creative common public domain (Creative Commons, 2020)



Public Domain Mark | *Creative Commons (CC0) Public Domain Mark*

Creative Commons License (CC)

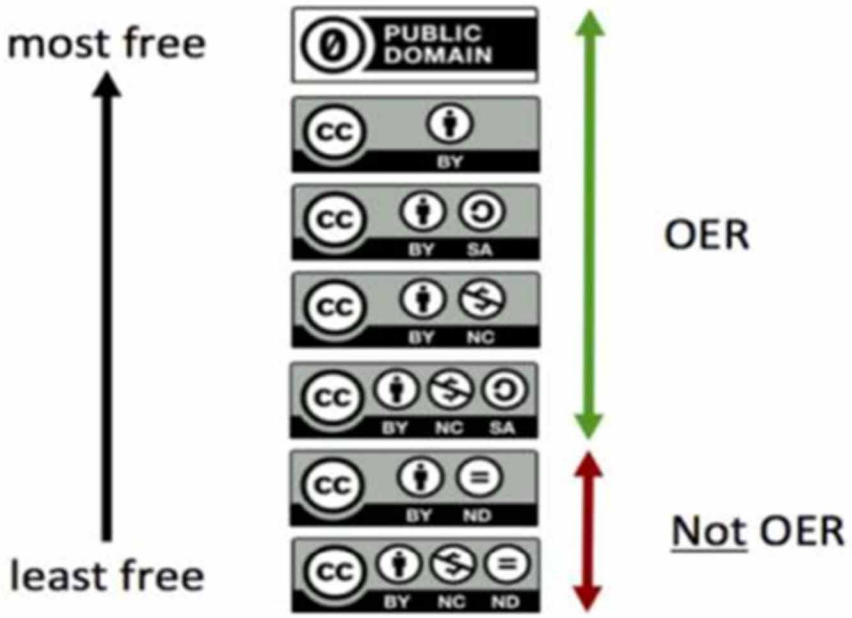
Creative Commons (CC) is a non-profit organization that supports free or low-cost tools to help creators publish their knowledge to a broader audience. There are six separate CC licenses, covering a continuum of openness, that allow authorization for others to use work in particular ways. These are the most commonly used open licenses for OER.

The most open Creative Commons licenses only require acknowledgment (giving credit) and allow nearly any use beyond that. Some less-open licenses have restrictions or prohibitions on industrial usage and customization. CC licensing marks are visible markings that indicate whether the work can be reused without contacting the creator or obtaining permission. When appropriately applied to digital content, a CC license includes a link to a human-readable summary of the license, as well as a link to the license's lawful deed. Figure 4 below shows the different license rights. Figure 5 shows the different possibilities and the scope of publishing openness.

Figure 4. Symbols and description of the license rights

Icon	Rights	Description
	Open	Free to share; adapt or modify
	Non-commercial (NC)	The material cannot be used for commercial reasons. Only for non-commercial purposes may licensees copy, distribute, exhibit, perform, and create derivative works and remixes based on the work.
	No Derivative Works (ND)	Only verbatim copies of the work, not derivative works or remixes based on it, may be copied, distributed, shown, or performed by licensees. Derivative works are permitted since version 4.0, however they must not be shared.
	Acknowledgement (BY)	We need to give proper credit, including a link to the license, and state whether or not any changes were made. You may be doing so in any reasonable fashion, but not in a way that implies the licensor approves of your usage.
	Share A like (SA)	License holders may only publish creative works under a license that is identical to (but not more restrictive than) the original work's license. Without share-alike, derivative works could be sublicensed under more restricted licence conditions, such as CC BY-NC.)

Figure 5. Different possibilities and the scope of openness of the publishing an e-content (Creative Commons, 2022.)



OER BASED ON NATURE OR FORMAT

Open Educational Resources are delivered in various formats like MOOC Courses, Textbooks or e-books, Lecture notes, Online Tutorials, Podcasts, or even as modules in Playlist based on the domain. The following section highlights and categorizes OER depending on the nature of its availability.

Massively Open Online Course

Massively Open Online Courses, or MOOCs, are one of the most popular online educational resources. MOOCs make remote learning equally accessible and cheap to students worldwide. Depending on the inquisitive user's needs, a person can choose either a single session to learn about a specific topic or a series of lessons to understand a subject thoroughly. There are various free MOOC providers on the Internet that charge reasonable prices. Some well-known MOOC providers even award certificates for completing a series of sessions and passing the associated assessment. It is worth noting that several higher education institutions are now awarding credit to students who complete MOOC courses. The Ministry of Education (MoE) and University Grants Commission (UGC) of India have promoted MOOC Courses as part of the course curriculum. Corporate giants are also promoting MOOCs through their marketing budgets.

Text Books/ E-Books

E-books are digital replicas of printed books that may be read on a computer or a specific portable device. Alternatively, they can be books created entirely on the Internet, without a physical counterpart. In reality, many humanities and science textbooks are already available in pdf format on the Internet.

Lecture Notes

Academicians, nowadays, have developed the habit of uploading their educational materials to the Internet. These materials include lecture notes, presentation slides, and video files. Uploading the files to cyberspace without expecting payment facilitates knowledge sharing. For example, SlideShare, a popular website, regularly shares presentation slides.

Online Tutorials

An online tutorial is a self-study exercise resource designed to teach a specific title on any particular domain. Online tutorials are student-centric resources, available as per convenience. The two most common types of online tutorials are recorded and interactive.

- **Recorded tutorials** are the videos or visual recordings of a subject expert providing ideas and information or delivering a demo.
- **Interactive tutorials:** A text document, application, or other Internet-based media designed to provide training for a wide range of tasks. A presentation of content, instructions for users to perform the tutorial exercises, are the common contents of online tutorials. The user receives feedback based on his activities and can go to other modules or sections.

Both forms of online tutorials can be used to augment schooling. Online tutorials are increasingly being used in both teaching and learning.

Podcasts

A podcast is a digital spoken audio recording that may be downloaded and listened to on the go. Streaming apps and podcasting services make it simple to keep track of the consumption backlog across many audio sources and listening devices. Podcasts can be used in various situations and by consumers and learners. Podcasts are good resources for self-paced learning, reinforcing the concepts learned in classrooms or a blended learning model, thereby creating a more dynamic teaching and learning platform. Using podcasts in the classroom has numerous advantages. Most podcasts are entirely free. In addition, one may get podcasts on almost every topic, from science to rare history lessons, and in nearly all genres, from literary fiction to in-depth investigation. As podcasting becomes more popular, more creators focus on content for children and teenagers.
Some popular OER podcasts are:

- **OEG Voices**: **OEG Voices** is a home for podcasts created by Open Education Global, and it includes some of the most popular OER podcasts. The team's goal was to provide users with information and connections to open education initiatives from all across the world.
- **HybridPod**: The HybridPod podcast (Hybrid Pedagogy, 2022) delves into critical digital pedagogy discussions, looking for ways to educate students and promote learning. Every edition of HybridPod developed by Chris Friend offers conversations with brilliant pedagogues from academia and beyond who share their views and understanding on improving learning and teaching in our everyday lives.

For example, The Education Podcast Network (EPN) family Butcher and Moore (2015) have created hundreds of informative podcasts which are widely recommended.

Playlist in YouTube

OER videos can be stored as playlists in channels like YouTube. YouTube Playlist is an online, free tool that lets us gather and arrange videos based on our interests or subjects. Any video on YouTube, and even one's work, can be added to a playlist. This is one of the efficient ways to keep track of the created videos. For instance, a collection of YouTube videos, some dedicated to instructional technology and others related to cuisine, can be divided into two playlists for viewers. It can be available to the public or kept private. After the videos have been arranged, they can be played one at a time. The playlist option facilitates users to get the complete material on a single interface. It aids in the discovery of videos when they are provided as playlists. This helps to create a better visitor experience too. YouTube indexes playlists, making it easier for others to find the various video content one has submitted. The following elements contribute to the appeal of YouTube playlists: cost, ease of use, visibility, and confidentiality.

For example, YouTubers create playlists that consist of a series of tutorials on finding and using open educational resources on various topics based on their specialization.

KEY PLAYERS IN THE OER SECTOR

The key players in the Open Education sector are pretty diverse. We can broadly understand them as a mix of educational platforms run by governments, private bodies, educational institutions, and individual members.

One of the early starters in the Open Education context happens to be The Open University (Open University, 2019). in England, which was founded in 1969 with the mission of being 'open to people, places, methods, and ideas.' Over the past fifty-plus years, it has grown to be the largest academic institution in the United Kingdom. It takes pride in mentioning that "over 70% of OU students are already in work, earning and learning." Using a similar model, the Indira Gandhi National Open University was approved by an act in the Parliament of India in 1985 (Wikipedia, 2020*).* With the tagline "People's University," IGNOU has a total enrollment of over four million students, and it claims to be the largest university in the world. While the Open University and IGNOU started as a space for promoting distance education, they gradually adopted the online modes of educational transaction.

One of the pioneers in the open and online educational domain happens to be the Massachusetts Institute of Technology's OpenCourseWare (MIT, 2018). With a mix of audio and video lectures, online textbooks, open courses, open online libraries, etc., enCourseWare set the trend for many other institutions to make education easily accessible to a broader society. Their 2020 OCW Impact Report states that 210 million individuals have accessed OCW material since their launch and that they have so far produced more than 2550 OCW courses and supplemental resources. During the pandemic, MIT's multiple Open Learning platforms like OCW Educator, Chalk Radio, MITx, etc., saw a spike in the number of people who started accessing their content during the pandemic phase. MIT News, published on April 16, 2020, mentions that "In addition to online courses, demand for MIT's other open learning resources has also increased dramatically since mid-March. As a result, visits to MIT's OpenCourseWare (OCW) site are up over 75 percent, as learners and educators use the lecture notes, exams, and videos from nearly 2,500 MIT courses."

Coursera (2022), founded in 2012 by Daphne Coller and Andrew Ng, is a global online learning platform that collaborates with more than 200 educational institutions and companies like the University of Michigan, Stanford University, Duke University, Google, Indian School of Business, IBM, Facebook, etc. On their website, it states that "82 million learners, 100+ Fortune 500 companies, and more than 6,000 campuses, businesses, and governments come to Coursera to access world-class learning—anytime, anywhere." While it started as an open educational resource, it has become a business venture. They offer a few open courses and make a majority of their other courses closed. During the pandemic, they opened up numerous modules for easy access. For example, at CHRIST University in Bangalore, like many other educational institutions worldwide, publishers and researchers were given access to more than 3200 courses for six months during the pandemic. Both the teaching fraternity and students were able to use the opportunity and gain knowledge. However, Coursera retracted this open-access initiative for multiple courses after this initial encouragement.

One of the most critical contributors to Open Education happens to be the Creative Commons (CC Global Network, 2022) Their licenses "...give everyone from individual creators to large institutions a standardized way to grant the public permission to use their creative work under copyright law. From the re-user's perspective, the presence of a Creative Commons license on a copyrighted work answers the question, "What can I do with this work?" With their six different license types that range from

most to least permissive ones, they help in legally sharing "...knowledge and creativity to build a more equitable, accessible, and innovative world."

As early as 1971, Project Gutenberg (Hart, 2004) became the first platform to provide free electronic books. One of the distinct features of Project Gutenberg is - in the words of its founder Michael Hart - is that they "... do not provide standards of accuracy above those as recommended by institutions such as the U.S. Library of Congress at the level of 99.95%. While most of our e-books exceed these standards and are presented in the most common formats, this is not a requirement; people are still encouraged to send us e-books in any format and at any accuracy level. We will ask for volunteers to convert them to other formats and to incrementally correct errors as time goes on."

The number of players in the OER sector has grown immensely over the past few years, ranging from TED to platforms like Khan Academy, Google Books, Unsplash, Soundcloud, and more. However, what matters for the typical learner is the open to closed spectrum that such educational resources position themselves in and how much they attend to the following recommendations made by UNESCO on Open Educational Resources (UNESCO, 2019).

1. Capacity building to create, access, reuse, adapt, and redistribute OER;
2. Supportive Policy;
3. Inclusive and Equitable Access to Quality OER;
4. Sustainability Models for OER; and
5. International Cooperation.

ORGANIZATION AND STORAGE OF OER CONTENT

OER storage mechanisms can be classified depending on the level of functionality provided by the OER channel (OECD, 2007). Most of the OER storage appears as follows:

- **Directories:** A directory contains a list of OER and connections to other online resources. For instance, the Commonwealth of Learning (COL) OER Directory and the Directory of Open Access Journals (DOAJ) are publishers and researchers' most frequently used directory services.
- **Platforms**: The term "platform" is referred to the specific digital tools designed to "do" something with OER. It would include tools for creating new OER or adapting old ones. Alternatively, the platform might be built to allow new OER to be licensed under an open license. WikiEducator is an example of the former. WikiEducator gives a platform for creating new content online.
- **Repositories:** A repository is an online database or collection of OER, usually maintained by a single institution. The MIT OpenCourseWare Repository is a very well example of an academic library.

OER Repositories

Anyone can utilize OER repositories to share and exchange resources, meaning that they might be users or producers or support the collaborative production of standard products. The first scenario is the user-producer model, and the second is the co-production model. However, there are intermediate models too. The first paradigm is much more likely than the second to be centralized. Because the quantity of

learning materials and repositories is continually increasing, it is critical to select the most influential and high-quality resources. OER repositorie**s**, maintained through a web interface, contain both resources and metadata (explanatory information about the resources). The metadata of the resources is used for searching, and high-quality metadata can cause repository resources to be indexed better by search engines. Alternative approaches to aid in a discovery like automatically generated metadata are being investigated, but it is unclear whether they will be scalable.
There are three categories of OER repositories:

- Local repository OER websites manage local archive resources and metadata (OECD, 2007).
- A third-party or external repository-Access to productive resources and diverse information stored in external repositories via OER websites.
- Repository hybrid or Hybrid repository- This type of repository provides access to the local and external storage provided by OER websites.

Several sites on the Internet, such as those discussed below, can help teachers or facilitators organize, deliver, and exchange OER for learning purposes. The OER resources can be classified as course materials, modules, textbooks, playlists, video streaming, tests, software, etc. The OER contents can be added to a student's online library or portfolio, and learners can even post.

- **Open Educational Resources (OER) Commons:** Members of OER Commons can share portfolios. Individual portfolio gives rapid access to the OER Commons usage history. The folio is dynamically created when we interact with OER material by rating and reviewing it. The portfolio can be shared with others if we wish to, and others can build on the existing. We can also look at other people's portfolios to see how they find, use, and connect with OER (OECD, 2007).
- **MERLOT:** Multimedia Educational Resources for Learning and Online Teaching (MERLOT) is a crowdsourced list of openly licensed e-learning, study, and professional development resources.

OPPORTUNITIES AND CHALLENGES

Digital Access and Equity

In less developed countries, the role of OER in ensuring a ranging and easier spread of knowledge is deeply felt. In this context, we need to acknowledge Swayam (Ministry of Education - Govt of India, 2022). an online platform run by the Government of India, in association with nine different institutions. As mentioned in the Swayam website, they seek to "bridge the digital divide for students who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy." However, the digital divide is pronounced, and OER continues to benefit the privileged more.

This rift in educational standards is highlighted in a UNICEF report that admits that "The pandemic has not only caused the wide rift in educational inequality to balloon but also exacerbated existing disparities." While some of the premier educational institutions in India adapted to the E-learning mode quickly during the pandemic and exploited what OER had to offer through platforms like Khan Academy, Swayam, Coursera, etc., many students from the poorer sections and rural regions of developing countries were

hit. Citing a Ministry of Rural Development report for the year 2017-18 (UNICEF Global Development Commons, 2020), the UNICEF report acknowledged "that only 47% of Indian households receive more than 12 hours of electricity and more than 36% of schools in India operate without electricity." With such rudimentary digital infrastructure not being available, the quick adaptation of digital ed-tech and OER remains a top-down model in a country with a distinct digital divide (UNICEF Global Development Commons, 2020). Providing digital infrastructure like devices, electricity, broadband connectivity, etc., remains a fundamental prerequisite for realizing and exploiting the potential of OER. Apart from the initiatives taken by the Government, Wiki Foundation, etc., we need more concerted efforts to turn "the digital divide into digital dividends using free content and open networks."

Creating a Culture of Self-Driven Learning

Whether the student accesses OER as part of formal education or as a part of hybrid learning, or out of one's own desire to learn, has a significant impact on how well and how much the OER is utilized. A self-driven learner is more likely to set learning goals; identify the aim of the OER module; and exploit the wide range of learning opportunities provided by OER in the form of lectures, assessments, discussion forums, additional reading materials etc. Moreover, they are likely to seek feedback as and when required, monitor their learning progress, and decide how to advance from there. Unfortunately, in an educational system heavily dependent on rote learning, a student's shift to e-learning with OER could be daunting.

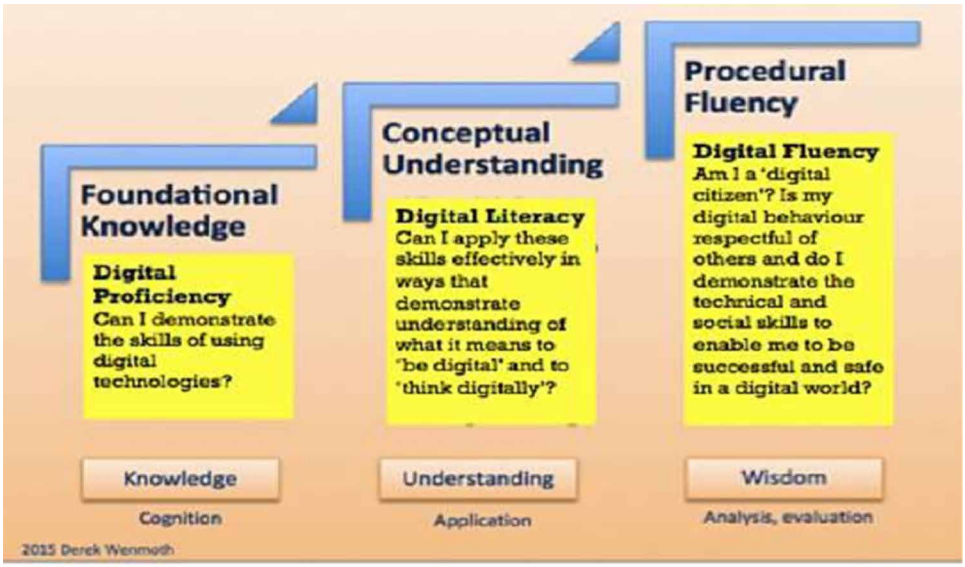
There is a need for introducing students to independent learning in their conventional school contexts so that as they graduate to higher education spaces, the optimal utilization of OER could be attained. Further, the conventional attitude that learning could stop after one step out of educational institutions needs to be countered with sustained exposure to the dynamic nature of 21st-century professional contexts and how lifelong learners are the ones who keep expanding their possibilities. Referring to George Siemens and Stephen Downes' "connectivist pedagogy," a report titled Open Education Resources: A Catalyst for Innovation by Orr, Rimini and Damme (2015) asserts that "High-level student-student interaction can be a way of harnessing the benefits of OER while reducing the challenges to successful learning. Facilitating a community of learners around the educational resources themselves can enrich the learning experience and ease the burden on the individual learner." Further, OER can promote problem-based thinking so that students are empowered to consume knowledge and apply the learning in appropriate ways.

Overcoming Digital Incompetence

One's work, leisure, and different aspects of day-to-day existence are dependent on digital literacy. To address the educational contexts of the 21st century, teachers require capacity-building opportunities that help them adapt to the digital education environment. Suppose the teachers themselves are unsure about digital education, its purpose, processes, potential, and know-how. In that case, it is sure to affect the learning prospects of students from conventional educational setups. While the digital natives are certain to adapt and adopt OER quickly, the digital immigrants within the teaching fraternity need a foundation in digital education. Taking stock of the different levels of digital literacy amidst the teaching community and tailoring appropriate capacity-building measures that build their digital competence and confidence is a necessary first step. Exposing them to the advantages of Open Education Resources and empowering them to integrate them into their educational ecosystem ought to be a follow-up process. Not only

should they be able to identify and access digital content and create teaching content and share it with the ones who seek it. As defined by Derek Wenmoth presented in Figure 6 Spencer (2015), educators could progress to a level of digital fluency to overcome technical incompetence:

Figure 6. Levels of digital fluency



When teachers move to the stage of digital fluency," they will be able to optimize the opportunities in the form of open education resources.

Exploiting Hybrid and Blended Learning Possibilities

The OER ecosystem is built on many factors like self-driven learning, flexible learning, re-learning, interactivity, peer-to-peer learning, life-long learning, etc. These features may not be the conventional classroom model of imparting education for varied reasons like an imbalanced teacher-student ratio, the pressure to deliver content and student assessments in a time-bound manner, etc. So, the shift from the chalk-and-talk pedagogy of the teaching fraternity from brick-and-mortar educational institutions to a model where OER is strategically integrated requires a rigorous orientation for academic institutions and, more specifically, to the teaching community. The teacher needs objectivity to understand how the OER ecosystem calls for learner-centric and learning-centric approaches in contrast to the teacher-driven mode of imparting education. Both blended and hybrid learning modes can be best utilized through OER, based on the contexts and needs, ensuring learning.

Addressing Life-long Learning

In the VUCAD (Volatile, Uncertain, Complex, Ambiguous, and Diverse) world in which we live, lifelong learning is a necessity. Gone are the days when one could assume that education is over after earning a

degree or two from a college or university. Contemporary knowledge transactions are dynamic, and the ones stuck with the stale, irrelevant, and unreliable knowledge will not survive. One needs to expand regularly, review, and update one's knowledge base and skillsets. However, when one is passed a college-going age and is held up with family and professional responsibilities, the means of acquiring knowledge in the traditional setup are very minimal. OER presents an excellent opportunity for the motivated learner as they are not just easily accessible but also empower the user to utilize them with minimal challenges of time and space. Lifelong learning enabled through OER can lead to better professional prospects, active citizenship, more knowledge production, and lay the foundation for a knowledge society.

OER as a Space for Knowledge Production

The OER ecosystem needs to be understood as a space for knowledge production. While OER has managed to significantly realign the teacher's role, it can also initiate a radical rethink regarding knowledge producers. As of now, the ratio of the knowledge producer to that of the consumer is obviously on the side of the consumers. However, OER can enable more members of the knowledge ecosystem to become prosumers. Like the Dalits in India, the marginalized communities can now use open education platforms that are egalitarian and considerate of diverse identities, subjectivities, and realities. They can share their knowledge with a broader section of society and invite more socio-political deliberations. Indian tribal communities that are forest-bound could share knowledge about their sense of ecology, community life, art, etc., and explore the possibilities of interacting with tribal and non-tribal communities from across the world. Such a move could open up new opportunities for people working in conservation science, botany, etc., to juxtapose their science-informed epistemology with the lived experience of forest dwellers.

While aspiring for such a revolution in our knowledge ecosystem, a stock-taking of the current constraints is necessitated. A quick assessment of Wikipedia (World Wide Web Foundation, 2021) could help us grasp the context better. In 2001, Jimmy Wales, the founder, could invite us to "Imagine a world in which every single person on the planet is given free access to the sum of all human knowledge" and add "that's what we're doing." After completing twenty years of service, Wiki has indeed become "one of the most beloved and trusted sites on the web, notching up more than 15 billion visits each month across 1.5 billion devices, making it the eighth-most-visited site in the world." While access has indeed increased, the ability of our society to use that knowledge and have the meta knowledge of when and why one could use it is not necessarily guaranteed. So, access alone may not be enough to realize the democratization of our knowledge ecosystem.

OERS AS ALL-INCLUSIVE PLATFORMS

The spread of OER in the past two decades has been scaled up; more players and more stand to benefit because of these developments. OER's capacity to break down barriers between institutions, between countries, and between formal, non-formal, and informal learning are indeed promising. However, mere access to OER alone cannot determine the usability of the resources. The shift is evident from what is referred to as "the pedagogy of scarcity to a pedagogy of abundance," as mentioned in Weller (2011). But one needs to see the ramifications of how the increased access plays out.

OER is neither the only model of accessing knowledge today nor the predominant model. Proprietary models that are closed continue to dominate the knowledge ecosystem. Swayam's attempt to bridge the

digital divide by taking learning to the most disadvantaged remains more of an experimental, small-scale venture in a country as diverse and extensive as India. It does cater to School Education, Out School Education, Undergraduate Education, and Postgraduate Education and offers certified courses across disciplines. However, with just 203 partnering institutes, 4024 completed courses, 118262 successful certifications, one can understand how this is more a symbolic act of proclaiming knowledge access and equity. This coexistence of open and closed knowledge ecosystems makes the democratization of knowledge challenging.

If infrastructure was a challenge in the initial years of open learning in the online space, it later became a challenge of internet bandwidth. With that too conquered, the problem has turned into one specializing in proprietary knowledge taking over the OER space to recruit more members for their profiteering model. The opportunistic intervention of Coursera during the pandemic is a classic example.

FUTURE DIRECTIONS

The OER is going to be a preferred teaching pedagogy down the line. The pandemic has helped the facilitator and the students get accustomed to the technique, and it is going to be a preferred mode of learning. The University Grant Commission (UGC) has allowed 30% of the syllabus to be delivered online in India. Furthermore, it will increase as many academic institutions, and industries contribute to it by lending support by providing Massive Open Online Courses (MOOCs), OERs, Video Streaming, and Online Archive for the Documents. There is something for everyone under an open license to utilize and gain knowledge. Openly licensed platforms are launched for persons with disabilities, and initiatives such as OER4Covid are introduced to help learners transition into online learning. These types of initiatives by the higher education institutes assure the future of education. It creates the opportunity for those who are willing to access knowledge but have some travel restrictions. In the end, it will be an opportunity for higher education institutions and experts to come up with MOOC, Video Playlist, Online study material to help in the dissemination of knowledge dissemination to the extent possible.

Although OER has its pitfalls (D'Antoni, 2009 and Hylén, 2006), one cannot ignore the benefits. While instructors may be unsure whether some of these materials are reliable or sustainable in a classroom, OER is valuable for the underprivileged. The rudimentary elements of open source are free courses, open licensing, and customizable, which can enhance necessary professional skills for the poor. As part of the UN 2030 Agenda, (United Nation, 2015), the future constitutes of building more inclusive and sustainable open education platforms and is predicted to achieve at least six of the Sustainable Development Goals (SDGs) - SDG 4 (Quality education), SDG 5 (Gender equality), SDG 9 (Industry, innovation, and infrastructure), SDG 10 (Reduced inequalities within and across countries), SDG 16 (Peace, justice and strong institutions) and SDG 17 (Partnerships for the goals).

CONCLUSION

OER is not novel but is a progressing and sustainable area of education. OER requires the necessary attention and initiative to grow and gain momentum to educate millions of people regardless of their age, location, and financial status. In India, the change in trend is quite prominent, with many higher education institutions offering online study material and making it accessible to the public. Many in-

sightful resources are available free of cost to individuals from cooking, art & craft, hobby classes to technology playlists from many experts across the globe. The market for open education is growing as it provides quality education at ease to everyone. Many market leaders like IBM, AWS, Google, etc., provide a quality education through online academies and training the faculty and upcoming workforce. The trained individuals are becoming assets for the organizations. Along with these companies, online learning platforms such as Coursera, Udemy, and Analytic Vidhya also provide many free courses for various learners on different specializations.

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KEY TERMS AND DEFINITIONS

Conceptual Understanding: Conceptual understanding is the ability to reason in situations involving the careful application of concept definitions, relations, or representations of either.

Creative Commons: Creative commons (CC) is a globally recognised non-profit organisation that offers free licenses for creators to employ when sharing their work with the public. These licenses enable the creator to grant permission to teachers and students who can freely copy, share, edit, and remix a CC work without obtaining the creator's permission.

Digital Educational Divide: According to the ACT Centre for Equity in Learning, the digital divide in education is the gap between those with sufficient knowledge of and access to technology and those without it.

Digital Fluency: In a digitally connected society, digital fluency is the ability to efficiently and ethically interpret information, discover meaning, design content, construct knowledge, and express ideas.

Foundational Knowledge: Foundational knowledge refers to the information, theories, principles, methods, skills, terminologies, and methods of reasoning necessary for advanced or independent learning in an educational context.

Open Education: Open education is an educational movement centered around the philosophies of inclusivity and collaboration to create high-quality learning.

Open Pedagogy: Open pedagogy is a reflective practice where students engage with the educational process to create ideas and resources.

Procedural Fluency: Procedural Fluency is the knowledge of methods, comprehension of when and how to utilise them effectively, and the necessity to execute them flexibly, accurately, and efficiently.

ENDNOTE

1. Gratis OA is free, but it isn't free. Free OA removes price barriers, but permission barriers remain. Libre OA is entirely free of charge and copyright and licensing limitations.

Chapter 15
E-Government and Semantics:
Digital Citizenship Approaching Inclusion and Equality in Santa Catarina, Brazil

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ABSTRACT

The increasing digital transformation in all segments of society has been creating demand in information management and access. Consequently, local and federal governments must adapt and launch digital services that enable inclusion and citizenship participation initiatives through digitalization and content management to meet these demands. Nevertheless, the simple conversion of physical forms to digital is not enough to enable access. This chapter highlights the relevance of the use of plain language towards information access. This work conducted action research supported by the Toyota Kata approach demonstrating how the change in the semantical construct in the forms and service description is significantly altered post digitalization of some services provided by the State of Santa Catarina Government. The results demonstrate that plain language impacts the comprehension and consumption of information, incurring more inclusive e-government services.

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INTRODUCTION

This chapter approaches Plain Language for Open Access through the perspective of a citizen-centric public services perspective, presenting a case analyze of the Toyota kata approach in Santa Catarina, Brazil. For the purpose of this study Open Access is understood as an instantiation of Open Data, meaning the publication of foolproof government practices targeting to make them more accessible and comprehensible to the citizens (Sanabria & Gomes, 2014). Based on this conceptual framework, it is concluded that the rapid transformations caused by the consolidation of a heavily digital environment imposes new challenges to the processes, procedures, and responsibilities of governments entities both locally and globally. This phenomenon prompts the necessity of clear and solidly defined strategic actions that aim to provide services to society, enabling and facilitating the digital transformation, improving the State's performance in various areas (Pesquisa, 2016).

Furthermore, the costs associated with the face-to-face service is usually higher compared to online services, which indicates that the implementation of digital services can result in significant savings to the government. In Brazil, this fact is proven in surveys conducted by the Ministry of Planning, Development, and Management, which show that face-to-face service has an average cost of R$43.68, while online service can reach R$1.20, representing a saving of more than 97% in public resources per transaction (BRASIL, 2018a). Further studies and initiatives focusing on digitization are reinforced by the Brazilian Ministry of Science, Technology, Innovations, and Communications (MCTIC) in the document entitled Brazilian Strategy for Digital Transformation (E-digital) (BRASIL, 2018a).

Nevertheless, digital transformation should be more than a simple conversion of physical forms to digital ones. The United Nations advocates that governments must be committed to developing and releasing public services available to everyone; it means 'leaving no one behind' (UN, 2018). Without a language adequation, unavoidably parts of the population that are unable to understand the bureaucratic and legal standardized language will be excluded. According to Fischer *et al.* (2019), actions that alleviate the barriers of textual comprehension that prevent full service to the entire population should be considered. This chapter sought to answer the following research question: Does the application of Plain Language on the government sites and service forms positively impacts citizen comprehension? This work aims to answer this question through action research at the Santa Catarina State Government where the study was conducted.

THEORETICAL BACKGROUND

The beginning of 1990 marks the process of e-government in the most rudimentary format with governments around the globe using internet-based technologies with some governments imposing service landscapes that are mandatory to some extent (Ebbers et al., 2008). In his work discussing e-government and the use of Information Communication Technologies (ICTs) and the knowledge management production in Brazil, Knight (2007) stresses the importance of political engagement in all levels, from local to State and federal, in creating cultural changes that will lead to a broader base in the use of technologies for socio-economic development. The project e-Brasil was part of an initiative aiming at creating awareness about the benefits of e-development strategies.

According to the Organization for Economic Cooperation and Development (OECD), the efficiency of digital governance in Brazil depends on a broader connection between objectives on e-government to

a digital government which will help the country capitalize from a more strategic approach to data and information management. The OECD highlights that Brazil has increased digital technologies in public sectors in the last decade, incurring a more responsive and functional government, fast to respond to citizens' demands, including business (OECD, 2018). However, the research work from OECD also argues that the complexity of the public sector in Brazil makes the digitalization processes difficult, demanding "state-of-the-art approaches to ensure coordination and accelerate capacity-building processes across agencies and levels of government" (OECD, 2018, para. 1). Furthermore, effective use of technologies and consistent policies across the country remains a challenge in a globalized and technologically advanced world, imposing to the Brazilian government the urgent need to build a framework and strategies for a digital government that reflects a complete reform of the public sector and is aligned with the OECD recommendation of the Council on Digital Government Strategies.

Schware and Deane (2003) discuss the importance of information technology structures availability preceding any e-government initiatives. The authors argue that: "E-government's building blocks are ICT tools" (p.12), defending that these tools heavily rely on the "availability of inexpensive, high-quality telecommunications services" (p.12). The authors advocate that a consistent and systematic e-government initiative contemplates all aspects impacting the project, from ICT tools to telecommunication policies and comprehensive alignment with the committee involved in designing and implementing the project, which should result in reduction of costs and redundance. Schware and Deane (2003) claim that "the ICT sector lacks the means and motivation to generate innovations required to support new initiatives in e-government and e-commerce." (p.12), and that "the available pool of ICT skilled workers leave the workforce and migrate, intensifying the brain drain" (p.12).

Concerning e-government effectiveness, Schware and Deane (2003) stress cases where citizens and business do not have access to e-government applications "due to prohibitive access costs for the internet and internet services and lack of internal buy-in and sustained funding from different government stakeholders and government agencies". (p.12). This challenge is an obstacle to upgrades of technological apparatuses, training, and staffing, as examples. In the study investigating the strategic importance of deploying strategic e-government programs, Schware and Deane (2003) defend that e-government initiatives must contemplate the key strategic aspects: direct client value, social value, government operational value, strategic political view, and government financial value, highlighting the importance of an alignment between those strategies towards a successful e-government program that is inclusive, low in cost, and operative across boarder.

The concept of e-Government encompasses the government's ability to use Information and Communication Technologies (ICTs) towards improving governmental operations, structures, and practices. It is designed to help the government deliver services and improve the relationship with citizens (Castelnovo, 2013). The research work of Twizeyimana and Anderson (2019) discusses the public value of e-government, defending that "it is supposed to create an understanding of public sector management" (p. 168). The authors highlight that the ultimate result is not solely money but the "public value", which according to the seminal work of Moore (1995), the idea of "public value" is defined in the concept of citizens' collective expectations related to the government and public services in general, where citizens are a perceived as stakeholders and categorized as customer.

THE CUSTOMER-BASED PERSPECTIVE ON E-GOVERNMENT AND THE IMPORTANCE OF PLAIN LANGUAGE IN BRAZIL: LABORATORIO IRIS

The customer-based perspective on e-government makes it even more urgent the need of the government to fully understand the citizen's demands, expectations, and, particularly, their needs, to align services that will effectively help the communities it serves. The digitalization process of government documents and other sources of information is part of making information accessible. Aspects involving minorities communities in various segments of society must be contemplated, including those related to literacy and physical limitations preventing or limiting access, including visually impaired, illiterate population, and digitally illiterate groups, to mention a few. The Ceará State Government, for instance, had developed a study laboratory named Iris Lab in partnership with the General State Attorney of Ceará (PGE-CE), aiming at collecting data from citizens on ways to improve the official portal and help citizens with taxes related inquires (Laboratório, 2020, para. 1) through more accessible language format.

The Iris Lab had created a space for citizens to brainstorm ideas and share doubts and concerns, providing valuable information to staff that is later applied to critical changes in the language and format of the content available in the government portal, adopting the plain language. The numerous case studies have made it possible for the government to understand individual cases, limitations, and needs of citizens. Though changes better serve the community by using semantics easily understood by those with little or limited formal education and literacy.

This study work conducted by Iris Lab through its workshop prompted discussions around the simple semantics as an approach to better serve the illiterate communities by changing the formal language customarily taken as too complicated and of little to no use even by those with some level of formal education and literacy. In the same line of thought, the Stata Catarina State Government created a Nidus Lab by the law decree #1098 of 01/13/2021 (Santa Catarina State, 2021). Nidus was originated from Latin, meaning nest, Nidus is a cozy space tailored to those destined to take great flight. The lab is an arm of the Santa Catarina State Administration Secretariat under the Technology and Innovation Directorate, promoting a connection between society, startups, and the State Government (NIDUS, 2021). Nidus is the Government of SC Open Innovation Hub, which connects market solutions to the challenges of the Santa Catarina State Government, offering better public services for the citizen and more efficiency in public management (NIDUS, 2021). In partnership with Iris Lab, they are promoting learning workshops to align the digital transformations working groups to understand the relevance and importance of citizens centric view and provide tools and skills to use plain language to approximate the citizens' language avoiding the bureaucratic and legal standardized language. Those learning workshops capacitated the AR project team to perform the language improvements on the digitalization project.

A Holistic Ecosystem Method on eGovernment and Plain Language in Brazil: Open and Inclusive Access

The use of plain language is not exclusive in Brazil, the official government of the United States of America website offers its citizens the PLAIN, Plain Language Action and Information Network, dedicated to the "idea that citizens deserve clear communication from the government (Plain language makes, 2021, para. 1). Furthermore, the government believes that plain language saves federal agencies time and money and provides superior services to its citizens. Therefore, Plain language makes (2021), has introduced a Writing Act of 2020 that included the guidelines in how to write clearly so users can:

- Find what they need
- Understand what they find
- Use what they find to meet their needs" (Plain language makes, 2021, para. 2)

Discussing the plain language in Brazil Araujo, Reinhard, and Cunha (2018) presented a work examining the electronic services while emphasizing the internet access ad user's competencies in using electronic government services in the country. The authors explore the use of ICTs as critical in providing adequate public services to citizens, arguing that technology applications expand "democratic practices and redefine how the government and its citizens interact" (p. 676). Araujo et al. (2018) state that in Brazil, e-gov initiatives have "become popular due to the variety of electronic services (e-services) available to the population, such as the electronic voting systems, and systems for filing income taxes returns, scheduling medical appointments, and registering students at public schools…" (p. 677), services that rely heavily on Information and Communication Technologies (ICTs) apparatuses.

The authors similarly explore variables and categories that include social class, internet access location, use of electronic government services, communication, looking up information and transactions, multimedia, education and work, and downloads, content creation, and sharing, concluding that access to the internet and social, economic statues are strongly correlated with Classes A and B access mostly from home. In contrast, Class D and E have 1% of access mostly from other's houses or telescopes, where services for internet access usually are paid, with results showing that those in the lower class have limited and restrict access to information primarily for professional purposes and activities that include electronic government services.

Sanabria and Gomes (2014) examine the e-government in Brazil, highlighting the executive committee of e-government created by a Decree from October 18, 2000 that regulates actions towards making government more open to citizens through ICT. This committee was assigned with the examination of the proposed policies and guidelines designed to allow new forms of electronic interaction with citizens. The focus of this committee was designed with the goal: "to promote citizenship and digital inclusion, to encourage the use of free software, to employ knowledge management as a means to articulate e-government and public policies, to optimize resources, and to integrate actions with other levels of government (regional and local). The Brazilian e-government structure has the executive committee, which is a technical committee in charge of conducting and controlling open-government projects, along with the Secretariat of Logistic and Information Technology (LODGE, 2017).

According to reports, the Brazilian government has several projects for improving citizens' access and transparency, including:

1. **Accessibility:** The citizens have access to software and documents that help them to build websites in order to interact with government web portals.
2. **Broadband**: Info via a program intended to expand high-speed Internet coverage in order to facilitate the access to government websites and services.
3. **Open data**: Publication of easy-to-use government procedures aiming to make them more available and understandable to the citizens. This aims to improve transparency, participation, and the possibility of generating knowledge through collaborative scientific investigations.
4. **Electronic purchases system**: A series of systems developed for fulfilling and monitoring electronic purchases. It includes a suppliers' database and information about bidding, procurement, and information about goods, services, transportation tickets, and allowances.

5. **Interinstitutional agreements**: Aiming at improving transparency and social control of the resources transferred to states and municipalities, the Brazilian government created the federal government inter-institutional portal.
6. **Domain management:** The executive committee regulates the creation of ".gov" domains in order to keep it safe of fraud and bad use.
7. **Government to government**: It is an attempt to make the whole network of government systems interconnected and functional.
8. **Digital inclusion:** It is an ambitious public policy aiming to take digital inclusion to every citizen in the country. It encompasses initiatives such as broadband to schools, computer to everyone (aiming to reduce the price of laptops), and so on.
9. **Free software:** It is a strategy for generating knowledge and intelligence in this domain in order to reduce costs by expanding the competition among software producers.

This systematic, ecosystem approach is a evidence of how the Brazilian government has made the decision to invest in a systematic process of adoption of advanced open-government practices through technology, although most of them apparently are still developing and increasing access to citizens.

Koskinen et al. (2020) discussed the ethical governance and ecosystems of e-government arguing that as services become more digitalized the needs for government to focus on effectiveness and efficiency increases. The authors highlight the aspect of trust and reliability as challenging aspects of e-government presenting a study where the relationship between citizens and the government are critical for the success of any e-government project and the built of a "better society for all" (p. 201).

Koskinen et al. (2020) state that e-Government is in fact "a shorter form of electronical government, which refers to the use of information and communication technology (ICT) tools and applications to enhance government" (p. 202), in accordance with the theories of Al-Hujran, Al-Debei, Chatfield, and Migdadi (2015) advocating for transparency, accountability, and public services as government encourages high participation from citizens for e-government services adoption, particularly in developing countries. Al-Hujran et al. (2015) urge the contemplation of socio-technological, political, and cultural factors, presenting a research model Technology Acceptance Model that incorporates a set of social, political, and cultural constructs: trust, perceived public value, and national culture at the core of the process, concluding that the citizen attitude is strongly correlated to the perceived value and ease to use solutions, incurring in more or less citizen engagement and ultimately the success of the e-government project.

The approach to an ecosystem is a holistic view that contemplates a multitude of factors influencing the success of e-government initiatives and impacting its chances of success. Rantanen and Koskinen (2019) presents a study on the ethical implications of e-government in society defining the meaning of economy ecosystem as "complex socio-technical system incorporating citizens, organizations, companies as well as governmental agencies, which uses electronic platforms to create and distribute value to its participants." (p. 205).

Based on that premise, Koskinen et al. (2020) draw attention to the fact that e-government ecosystems are not solely about digitalization but efficiency in the way technological innovations are applied towards the betterment of processes, procedures, and services.

The citizens' perspective regarding the usefulness of e-government solutions is imperative for strong and higher engagement, and the guarantee of high integrity, ethical compliances, political, social, and technological restrictors, and potential, are determinants factors affecting how society will receive, process,

adopt, and use e-government. Therefore, the voice of citizens must be contemplated as e-government launch services and solutions, where inclusion represents a critical and determinant factor of efficiency.

Mont'Alvão, Clemente, and Ribeiro (2021) presented a work evaluating the health campaigns' graphical aspects considering plain language as an inclusive approach, finding that barriers to informative material were the language utilized, which prevented the populations from access to information that was crucial in making decisions about their health. Therefore, the study of Mont'Alvão et al. (2021) stresses that the government must adopt a clear and accessible language, so citizens will feel better educated and informed as they learn about their health and the options available to them.

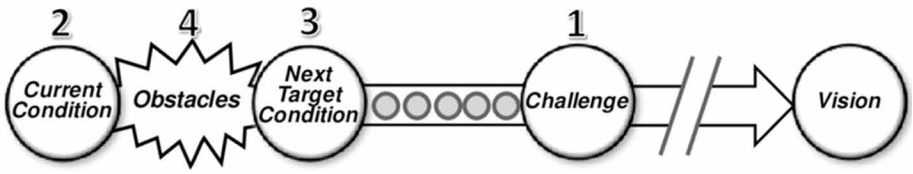
TOYOTA KATA APPROACH IN SANTA CATARINA: METHODOLOGICAL PROCEDURES

Aiming at verifying if Plain Language (PL) positively impacts citizen comprehension, the authors conducted action research (AR), using the Toyota Kata (TK) approach during the State of Santa Catarina Government digital transformation project. The project concerns the digitalization of some forms and describes the service description provided by the official Santa Catarina State service portal.

It is worth mentioning that the TK concept comprises teaching routines used to preserve and produce knowledge to and pass on know-how. Rother (2009), states that "Kata" is a mindset, meaning a pattern or shape which can be trained to develop particular skills. TK aim is to grow systematic and scientific habits to develop answers in dynamic and uncertain situations.

Toyota Kata approach, according to Rother (2009), has four stages, as can be seen on Figure 1, dedicated to enhancement named Improvement Kata:

Figure 1. Improvement Kata four stages
Source: Adapted from Rother (2009)



Stage One: Define the challenge: Before any group action, rescue the long-term organizational vision. With that in mind define the challenge aligned;

Stage Two: Understand the current situation: Make a comparison with the challenge, check where you are now, based on facts and data;

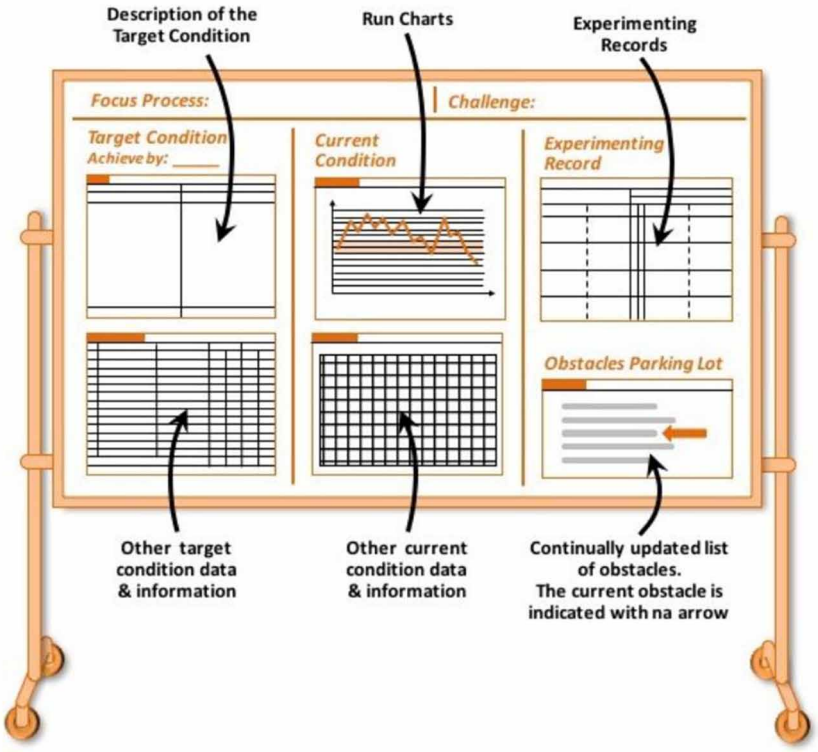
Stage Three: Set the following target condition: Determine the target, meaning where you want to be next. A target condition elucidates an attribute combination of what is wanted on a specific future date. Formerly is not known accurately how to get there, so a target condition is a learning task;

Stage Four: Aim toward the target condition: The improvement Kata comprehends an interactive and systematic routine to overpass the unpredictable gray area between the current condition and the target condition. Accomplishing by PDCA (plan, do, check, and act) cycles and fast experiments, men-

tees while attempting to reach their target condition, can comprehend and adapt based on what they are learning in the PDCA process.

To facilitate the TK approach, also for a better vision, TK prescribes a storyboard (Figure 2), where those four steps are accomplished. On each TK cycle, the board is updated.

Figure 2. Story board
Source: Adapted from Rother (2009)



The action research has two main objectives: one technical objective to solve a problem, and two a scientific objective to develop or produce knowledge (TRIPP, 2005). The technical objective in this research was to deliver services that can be the most understandable as possible by citizens, as stated by UN (2018), "leaving no one behind," and the scientific objective to verify the Plain Language effectiveness.

It is worth mentioning that in an AR, "the high involvement of the researcher with the research subjects allows for access to rich and in-depth research data" and also "researchers can overcome the problem of trying to understand the ill-structured, fuzzy world of complex organizations by applying action research" (Kirwan, 2009, p. 239). Having this enlightenment in mind, one of the chapter authors took the opportunity to verify if PL can mitigate comprehension issues, as he has a project manager role on the mentioned project, also he took place as the TK coach and the project team the leaner role.

Each experiment TK cycle was documented on the TK storyboard, as can be seen in Figure 2. Firstly, the team (learners) registers the target condition, current condition, and obstacles that prevent reaching the target condition. With this information register, the next step is to plan to "attack" a specific obstacle

and also register what is expected from this attack. After each TK cycle, the learner registers what happened and what he learned, then realigns with the coach.

Toyota Kata approach: ACTION RESEARCH LIMITATIONS

During the research process it was found limitations with the methodological approach using Action Research which were overcame by categorizing limitations and potential limitations and drawing a strategy to handle challenges and accomplish the research goals, based on the approach of Kirwan (2009), as described below:

Table 1. Limitations of using action research and how the researchers overcame

Possible limitations of AR	How to address the limitation	How this was achieved in this work
Achieving stringency/rigor – the way of assuring the quality of the data collected	Use of action research cycles to provide adequate iterations	The AR cycles were aligned with the Project sprints / TK cycle.
	Planning of methodical data collection methods	The documents and project sprints were used as the data collection source and method. Also, the researcher, is project manager, was careful not to influence the business analyst, user experience designer, and key users' answers, to minimize researcher bias.
	Careful nurturing of collaboration with subjects	The collaboration started after the project assignment and continued throughout the project life cycle.
	Interpretations will be developed as part of the data collections	The researcher and project team developed interpretations together. In each project sprint / TK cycle, coming into a result consensus.
	The relevant literature will be accessed as part of the interpretation to widen the dialectic.	The literature was accessed to support the research.
	Multiple data sources will be accessed to provide a dialectic	The researcher and the project team accessed the primary data sources together. Supported by relevant academic literature and also the internal project documents.
	Establish an ethical client-system infrastructure and research environment	It was agreed that the digital transformation project would be used as the proposed research environment, and the researcher would have unlimited access to any document, information, or relevant data related to the research project.
Validity – are the findings really about what they appear to be?	Conscious and deliberate enactment of the action research cycles	Each action research cycle was aligned with project sprints / TK cycles.
Researcher bias/Lack of impartiality	The researcher needs to consider the extent to which the story is a good presentation of what has taken place.	The researcher was meticulous in following project sprints, not prompting the project team to preview established answers. Thus, they were free to answer by his own will.
Generalizability – the extent to which the findings are equally applicable in other settings	It will not be a problem if the researcher does not claim that the results, conclusions, or theory can be generalized.	This study was concerned with this specific estate government in this specific contest. However, it seems to be reasonable that it can occur with other governments' digital services.

Source: Adapted from Kirwan (2009)

Once the methodological approach was exposed, we passed to enlighten with the theoretical background and proceeded with the drawing of conclusions.

RESEARCH RESULTS

Preceding the action research, some understanding alignments were performed. Digitalization must be user-centric, and governmental digitalization must be citizen-centric. Having this context in mind, what is written on the websites, applications, and other digital solutions must be the main focus, and plan the solutions using their "shoes". Citizens are persons of different ages, different education levels, even no formal education. So, the digitalization solution must consider this and ensure that the services exposed can be understandable, not only for experts, lawyers, or highly educated persons.

Ensuring language adequation clarifying the bureaucratic and legal standardized language must be considered in digitalization. Unfortunately, when it is not, parts of the population for sure will be excluded. They will not comprehend was is explained or needed to request the service, for instance.

Having the clear understanding regarding this issue, the action research was conducted in the state of Santa Catarina State digitalization project. First, the AR cycle was aligned with Project sprints / TK cycles. Thus, it has no impact on the way the project was conducted. Secondly, as primary data, the documents and project sprints were used as the data collection source and method. Thirdly, to avoid bias, the project manager, one of the researchers, was careful not to influence the business analyst, user experience designer, and key users' answers. The project consists of digital transformation all the services described at the State of Santa Catarina service charter, that can be transformed into digital service. The AR occurred with the digitalization of some of those services and It was conducted collaboratively. The collaborative work started after the project assignment and continued throughout the project life cycle. It is important to highlight that the project team developed interpretations together, in each TK cycle, coming into a result consensus which were register on the storyboard and project documents.

Furthermore, the literature was accessed to support the research approach and methodology. The researchers were meticulous in following the project sprints and TK cycles, not prompting the project team to preview established answers. They were free to answer at their own will.

TOYOTA KATA CLASSIFICATION

First Kata Cycle

Primarily, it was defined as a challenge/vision to make the service form citizen understandable. Therefore, following the TK approach, the current condition was assessed, and the results were described in the storyboard, Table 2. Afterwards, the target condition and in the sequence the obstacles were recognized and written on the storyboard. The obstacle "Identify the terms and parts that need improvements" was selected to be attacked in the first cycle. Based on that principle, the action was planned, and what was expected was described with the accomplishment of this action.

Table 2. Storyboard first cycle

<table>
<tr><th colspan="2">Process: Adequate form language</th><th colspan="2">Challenger: Make the form citizen understandable</th></tr>
<tr><td rowspan="3">Target Condition:
Transform the site and services more citizen understandable avoiding bureaucratic and legal standardized language</td><td rowspan="3">Current Condition:
The service site and forms are written with bureaucratic and legal standardized language.</td><td>What was planned?
1- Revise the text</td><td>What was expected?
1- have a form citizen understandable</td></tr>
<tr><td>What happened?</td><td>What was learned?</td></tr>
<tr><td colspan="2">Obstacles:
1 - Identify the terms and parts that need improvements</td></tr>
</table>

Source: Primary Data

Subsequently, with the definitions set, the first coaching cycle was performed. The team members (learners) explained to the project manager (coach) the structure of the storyboard. With the endorsement, the team ran the first cycle of the experimentation, carrying out the proposed action.

Second Kata Cycle

With the experimental aspect conducted, the project team recorded what happened and what was learned, and the new condition in the storyboard, Table 3. During the documentation of the findings, it was verified that some different terms having the same thing were source of confusion to the citizens and should be standardized. Thus, all the actions which occurred on the second TK cycle were collected and described in the storyboard.

Table 3. Storyboard second cycle

<table>
<tr><th colspan="2">Process: Adequate form language</th><th colspan="2">Challenger: Make the form citizen understandable</th></tr>
<tr><td rowspan="3">Target Condition:
Transform the site and services more citizen understandable avoiding bureaucratic and legal standardized language</td><td rowspan="3">Current Condition:
The service site and forms are written with bureaucratic and legal standardized language.
The service site and forms have less bureaucratic and legal standardized language.</td><td>What was planned?
1- Revise the text</td><td>What was expected?
1- have a form citizen understandable</td></tr>
<tr><td>What happened?
1 – Legal language terms were identified.
2 – Different bureaucratic terms that meant the same thing that is confusing the form were identified, and solutions were proposed</td><td>What was learned?
1 – here is another way of telling the same thing without legal language.
2 – Make a term normalization is needed.</td></tr>
<tr><td colspan="2">Obstacles:
1 - Identify the terms and parts that need improvements
2 – Convince the department that provides the service to avoid using bureaucratic and legal standardized language</td></tr>
</table>

Source: Primary Data

As shown in the project sprints, the use of user-centric perspective associated with PL, highlighted the use of some words that drew the attention of the team of researchers; as an example: *honorários advocatícios* (attorney honorarium) changed to the *honorarium* to attorney fees (*pagamento ao advo-*

gado). Additionally, all kind juridic terms in *Latin*, were changed whenever possible. In situations when the term could not be changed, researchers created a hint field designed to bring additional information about the term explaining its meaning further in a simpler language. Another example, in the sentence: Regarding pension, some different words with similar meanings are used: *ex servidor* (former public servant), *instituidor* (settlor), *ex segurado* (former insured), *falecido* (deceased). The three first terms were used at the same form and could be hard to understand by the citizens that lost the relative and are going in the process of requesting the benefits. Therefore, as a solution, first, the terms were changed and simplified in the form. Secondly, the hint option was created and available with a hover box, which allows users to access the element upon moving the mouse over the graphic; therefore, in this case, information explaining that meaning of the terminology and the purpose of the form initiating the claim for benefits from the deceased, see Figure 3.

Figure 3. Service form example with facilitating hint
Source: Authors

Another aspect that the PL perspective highlighted was the use of placeholders on the form. A placeholder is associated with a form field as an element of a sentence required by syntactic constraints but carries little or no semantic information. The syntactic can assist the citizen on a better comprehension, as can be seen in Figure 4.

Figure 4. Adding placeholder to a better citizen understanding
Source: Authors

The project continued with other Toyota Kata cycles, identifying and improving the language for the government digital services. Nevertheless, it is reasonable to assume that those two cycles demonstrate how the use the plain language, its impact and benefits; and how the solutions proposed to address the issues identified and emphasized in this study are equally relevant for an e-government successful initiative.

FINAL CONSIDERATIONS

The result of this study demonstrated through the Action Research that the use of Plain Language on the government sites and service forms have positively impacted citizen comprehension and improved interaction, allowing a more transparent Open Access approach. Throughout the interaction between the coach and learner during the action research with the Toyota kata approach, proved to be critical in learning how to design a service that is more inclusive and easily understood by the citizens.

It was observed that the scientific way in which TK approach deals with many obstacles, by arranging and schematizing interactions approaching one at a time, was successful in dealing with bureaucratic and legal standardized language and transforming it into a comprehensive language for the citizens.

As a result of the theories presented and the alignment of the Toyota Kata approach this chapter aimed at highlighting the significant contribution in the use of Plain Language for successful e-government projects. Determinant aspects of social, technological infrastructure, telecommunications, among culture are some examples of factors interfering-and even determining- the applicability and success of e-government initiatives.

The authors are aware that the present study is not without limitations. It was concerned with a specific case in the State Government in Santa Catarina. Additionally, the choice of AR method, although efficient, considering the scope and purpose of this study. However, it is reasonable to assume that the procedures to mitigate the method limitations were followed and the results meaningful. Also, it is suitable to assume that the same language issues can occur with other governments' digital services. Finally, this chapter proposes some future research to evaluate the citizen perception using the traditional, not digitalized form without using plain language against the one that has used it. Another research could request the citizen to cast what terms they have most challenging to comprehend and rank in bureaucratic and legal standardized language.

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Chapter 16
Article Processing Charges and Their Impact in Open Access Publishing

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ABSTRACT

Knowledge transfer is the key to the sustained growth of human civilization. This chapter on open access and article processing charges aims at addressing the various issues associated with open access publishing as a business model with a distinct opportunity. The chapter throws light on article processing charges (APC), the relevance of impact factor, citations, and pricing. The complexities the researchers confront, and the rise of predatory journals and their concerns are discussed in detail. The ethical dimensions of publishing and the role and relevance of the Committee on Publication Ethics (COPE) are also explored. This chapter dwells on some of the remedial measures to improve the awareness and practices among the diverse stakeholders.

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INTRODUCTION

Knowledge is power and acquired knowledge has to be shared for humanity to survive and progress. With the development in communication technologies, the shared knowledge space has increased manifold. Dissemination of knowledge is one of the key factors in the progress of civilization, as is evident in the advancements in science and technology, education, healthcare etc. In this era of internet and digital communication, there is no dearth of information, but evidence-based knowledge transfer is the key to the sustained growth of human civilization .This is of paramount importance in academia and research. However, access to authentic and relevant information is not easy. One of the reasons for low-quality research across the globe is the lack of access to relevant, credible and appropriate resources. Individual authors need to make payments to access articles from quality journals. Open access publication is an important development in this context and has come as a distinct opportunity for the academic and the research community to publish and to have access to quality research work.

The open access publishing model helps the research community in having access to a wide range of research work not accessible earlier to a majority of knowledge creators and was a deterrent to research progress. They can now have better access and greater scope for publication. It also gives high visibility to the authors' works and creates wider scope for collaborative work. With the publication, citation, h-index, i10 index becoming the Academic Performance Indicators (API) in institutions of higher education, the open access model of publication is more welcoming to the academia. The discussions in this chapter will focus on the open access centred on the academia. The chapter begins by introducing the Open Access as business model with its variants .The focus is on Article Processing Charges (APC), the relevance of impact factor, citations, and the pricing of the big players in the publishing industry and its impact on the researchers. This is followed by a discussion on the concerns and complexities faced by the researchers and how APC is both an opportunity and at times a burden to the authors in the new open access model. The ethical dimensions of publishing and the concerns over the rising predatory journals are also explored. The role and relevance of the Committee on Publication Ethics (COPE) and the need and ways in which the scientific community can mitigate the problems in publishing has also been touched upon.

OPEN ACCESS AS A BUSINESS MODEL

Knowledge is not only power, it is power and money. And it is power and money like never before (Kerr, 1994, pp. 9-15). Open access (OA) is the provision of free and unrestricted online access to research outputs such as journal articles, books, amongst others. Published research outputs can now be accessed without the usual subscription fees. Open access (OA) supports the researcher to access the earlier work of most authors with little or no restrictions. Publication of Journal articles usually fall under two business models

1. Subscription based, where individuals or institutions subscribe to the journals and make the payment.
2. Open access journals where Article publishing charges (payments) are borne by the authors, institutions /universities or funding agencies. Article Processing Charge (APC) is the central funding mechanism for open access journals (Solomon & Bjork, 2012).

Interestingly the open access model seems to fall under different variants depending on the business model followed by publishers (Omiunu 2019; Suber, 2012). This at least primarily includes "gold, green, and hybrid models". In Gold open access model, the publications is freely available on the publisher's website immediately. This has the advantage of increased visibility and has an impact on how frequently it is cited.

The green Open Access enables authors to archive their own work on a website controlled by them, or their funder, or on an independent repository. This version of the article is called as the post print which is almost the accepted manuscript after peer review. The green open access allows the authors to republish the articles in various other open access repositories like Google scholar, research gate etc. The third is the hybrid open access journals where some articles are openly available after payment while other articles remain closed as in subscription based journals. Journals that do not come with any financial obstacles for authors as well as readers are called diamond or platinum open access (Fleming et al., 2021; Haschak, 2007).

Now with the open access publishing and breakthrough in technology, it is easier to collaborate across disciplines and across national boundaries. The research output has increased manifold from across the globe unlike in earlier times where the research output was more from the west. More scientific papers being published from China compared to United States (US National Science Foundation, 2018) is a testimony to it. The open access model is one of the biggest positive changes in the publishing industry and benefits the research community. This business model has also some questionable issues which need to be fixed. A few of the trends and developments in the industry is discussed below.

The Big Players

A small number of big publishers with their competitive advantage get more submissions and assert themselves in the market place (Woodmass et al., 2015). The Open access publishing has created an explosion of titles, most of which seem to be competing for a small slice of a fixed pie (Davis, 2009, pp. 3-8). When open access journals are highly selective to maintain rigorous quality control and use innovative technologies in disseminating information, it becomes very expensive. It can also be noted that while highly selective journals running in the open access mode struggle to break even at times, large-volume of low-selectivity open access publishing generates substantial profit (Leptin, 2012, pp. 1279-1282).

Gold Access Model and Research Institutions

As the number of researchers publishes their work in gold access model, the universities and other research institutions have to bear the APC charges which are beyond the annual budgets for journal subscriptions. The Research-intensive institutions would pay the lion's share and this would subsidise free access for less research-intensive institutions. This may lead to questionable dominance of scientific publishing by richer institutions (All European Academies Report, 2018).

The other publishers who are highly selective may struggle to break even and large number of open access journals may end up compromising on quality and increasing volumes. These complexities along with different requirements and reporting for gold, green, hybrid model raises a number of ethical concerns and also creates confusion for the researcher's both in having access to and contributing to the knowledge pool.

Article Processing Charges (APC)

The Open access model is a matter of much debate on certain dimensions. One of the contentious issues is the Article Processing Charges (APC). With the rise in publication costs, the authors have to pay APCs upfront to cover the cost of publishing most of the time. Publishers mention different criteria they use to decide on the APCs. Elsevier publication, one of the leading private publishing houses, claims that it uses journal quality, the journal's editorial and technical processes, competitive considerations, market conditions and other revenue streams associated with the journal as criteria for deciding on APCs for its journals. Such business models bring a lot of revenue to the publishers. However, the fact remains that the authors and their institutions pay for knowledge creation and also to access the same.

Majority of the publishing houses generally do charge the same APC for authors coming from countries with deep economic disparities. But some journals do charge variations of APC. Considering the disparities in income they charge moderately for lower-middle income countries and comparatively lesser for authors from the low income countries. Also, APCs are based on the number of pages of article submitted by the researcher. The adoption model of APC is sometimes different based on the field and region (Asai, 2019, pp. 44-56). It has to be stated that not all open access journals charge their authors with publishing fees. It is evidenced that most of the open access journals found in Latin America, followed by Middle East and Eastern Europe Countries do not charge APC (Appel & Albagli, 2019).

Pricing

The APCs are listed on publisher websites or are recorded by Directory of Open Access Journals (Morrison et al., 2015). The average prices paid for Article Processing Charge (APC) is between 905 EURO (Pinfield & Middleton, 2016) and 1479 EURO (Pieper & Broschinski,2018) . This has only increased over time.

In 2021 (Morrison et al., 2021) it was evidenced that global average APC per journal has increased from 906 USD to 958 USD per journal whereas global average of per article has been raised from 904 USD to 1626 USD which reflects that there are tremendous changes in APC especially in articles than in journals. The study also highlights that authors prefer to publish in most expensive journals .The highest APC collected is in the field of biomedicine, health sciences, followed by biology, education, social sciences, law, political sciences and life sciences (Solomon & Bjork, 2012).

APC or publication fees shifts the burden of payment from readers to authors. Authors end up paying sometimes both, to have access to relevant journals from subscription journals and also end up paying to get their work published in open access journals. They also have to pay to publish in Hybrid journals in which individual articles in a subscription journal can be made open access. 'Nature' has recently made its articles open access moving from its subscription only publishing. The publishers charge a whopping $11390. Higher the popularity and citation index, higher the processing charges. The average APC for hybrid journals has been calculated to be almost twice as high as APCs from full open access publishers (Björk et al., 2014). Journals with high impact factors from major publishers tend to have the highest APCs.

APC, Citation Index and Impact Factor

The reputation of the journal is determined by the journal metrics such as number of individual citations, institutional citations, impact factor and scholarly publications. The impact factor will be estimated on the basis of number of citations done in the previous two years in the respective journals. If the articles in the respective journals gets more citations, it will increase the impact factor and vice versa. At times many researchers may not have access to articles in subscription journals due to the high APC and may look for freely available sources. This may lead to decrease in the citations of the papers in the respective journals. Accordingly, the impact factor of those journals tends be affected. However, the evidence found in a study (Budzinski et al.,2020) shows that Journal Impact Factor have positive and significant relationship with the Article Processing Charges (APC). Wren's study found that papers from high-impact journals were more likely to have free online copies at other locations around the web than papers from low-impact journals (Wren, 2005, pp. 1128-1145).

(Asai, 2019, pp. 44-56) has identified publisher strategies with regard to APC. The first is the generation of revenue from the open access publishing which makes APC positively correlated with the citation index and the second is that APCs do have a high correlation with the number of articles submitted, which further attracts more submissions from the researchers. Also the type of publisher plays a major role in attracting more submissions (Budzinski et al., 2020). The study explored the correlation matrix and evidenced that the size and age of the publishers is correlated with the APC. The five popular publishing houses charging higher APC are SAGE, Elsevier, Springer, Wiley and Taylor & Francis (Asai, 2019, pp. 44-56)

APC - A Burden to the Authors?

In a study conducted at Icahn School of Medicine at Mount Sinai, which includes 310 faculty members, (Halevi & Walsh, 2021), to examine how authors prepare for and fund APCs, 50% of them include anticipated APC costs in grant applications, and 16% of faculty pay APCs using personal funds. The institution published around 5714 articles, out of which 2860 were published as Open Access (OA) and the payment requirement in the form APC, for most of these articles ranged from $1500 to over $5000. Faculty members across institutions are required to publish every year. When publishing happens every year, one can imagine the amount of money that goes into payment as APC especially from personal sources. One reason could be that not all authors have access to funders or are not aware of its sources. The journals of five major academic publishers like Elsevier, Springer Nature Group, Wiley-Blackwell, Taylor & Francis, and Sage are found to be hybrid journals. A Hybrid Open Access publishing model is one in which some articles are made openly available, against the payment of an Article Processing Charge (APC). Here the readers need a subscription or pay to view individual articles. This model allows the authors the possibility to open up their individual article as Open Access immediately upon publication, but only on payment of charges similar to APC. Most top subscription journals as already mentioned, are hybrid journals, whose price levels are typically around 3,000 USD, which many authors and their institutions perceive as high (Tenopir et al., 2017). This is a matter of even greater concern to the authors from developing and under developed nations.

The growth in hybrid journals has obviously brought about major changes in the funding infrastructure with more and more research funders coming up with grants to bear APC. However the flip side to it is that if the author uses the grant fund for APC, it correspondingly decreases the use of fund for other

assignments like conferences, research assistants etc. It gets wrapped into the general research funding. Sometimes institutional funds such as library budgets are also used to pay APCs, which creates a situation wherein an institution is paying subscription fees as well as APCs, often to the same publishers (Cantrell et., 2020; O'Hanlon et al.,2020). These factors suggest that the burden of APC is more on the authors who have to pay for knowledge creation.

APC- The Ethical Dimension

The Open access models have the potential to breed unethical practices among authors. With publication being one of the academic performance indicators, academicians choose to publish regularly especially in journals with high impact factor and potential for greater citation. Though APCs are higher depending on the geographical location, discipline and the type of journals, most authors prefer publishing in journals with APCs high or low. With more and more submissions and not very high standards of review, causes the journals to be delisted from popular databases. This is unfortunate and goes against the career prospects for authors whose work has been up to certain standards. Resultant duplicate submissions and redundant publications in open access journals can be on the rise only to be categorised as clone or predatory journals on a later date. Sometimes original work and significant findings published in such journals may not get noticed.
Ethical issues can be classified to include the following (All European Academies Report, 2018)

1. Possibility of restriction in academic freedom
2. Emergence of APC figure as a measure of quality
3. Mushrooming of bogus ('predatory') journals
4. Increased use of bogus journals
5. Hybrid journals – 'double dipping'

As publishers move their economic model from high-priced subscription journals to high-priced article-processing fees, it creates new pressures on research budgets for those without generous funding. This is a bigger problem in low income countries where funding is sparce. The ethics of access have to do with recognizing people's right to know what is already known, as well as having access to it. The level of access is often reduced by the financial interests of publishers in a market in which there is little sense of a rational order, given huge discrepancies in prices for similar products (Willinsky & Alperin, 2011). This becomes a limitation to the researchers in having access to scholarly resources in terms of quality of knowledge that is already there but access limited and for the new knowledge it would have likely inspired.

Circumstance may warrant that researchers may find themselves restricted to publishing their work in less appropriate journal either due to the APC charges (non-availability of funds) or may be due to the requirement of different open access models. This especially is a matter of concern for researchers in third world countries where they are deprived of an equal opportunity compared to their peers from other developed nations and the funding process is well organised. This creates a wider gap in the research outputs between countries and questions of freedom of science and principle of equal opportunity (All European Academies Report, 2018)

The Rise of Predatory Journals

The 'publish or perish' bench mark for career advancements and high APC charges as a metric for quality can create a false standard or criteria for assessing scientific excellence. These pressures indirectly or directly lead to the uncontrolled growth of predatory and cloned journals which are a main concern. This vicious cycle has to be addressed. The researchers in a way get penalised in spite of their knowledge creation. (Shen & Björk, 2015) survey found 8,000 predatory journals published around 400,000 articles. The number only increases over the years. In the process good quality research can also be delisted which is a big discouragement to the scientific community. Some of the unethical practices in closed-access journals but which are not generally seen as unethical are practised in open access journals as well. For example, citation manipulations where authors are deliberately encouraged to include references which can increase citations of the journal.

Why Researchers Publish in Predatory Journals?

With all the complexities discussed above, researchers may find it easier to disseminate their work in predatory or bogus journals. Genuine researchers may do so either out of ignorance or poor guidance from their peers. Increasing the career prospects is found to be one of the main reasons for researchers to pay and publish with low standards of peer review leading to low quality output. Awareness is also a main issue. Researchers may not be able to differentiate between a quality open access journal and a bogus one. The reason is predatory journals appear to be legitimate (Lalu et al., 2017).

Below are the Salient evidence-based characteristics of potential predatory journals as described by (Riley et al., 2017)

1. The scope of interest includes non-biomedical subjects alongside biomedical topics.
2. The website contains spelling and grammar errors.
3. Images are distorted/fuzzy, intended to look like something they are not, or which are unauthorised.
   4. The homepage language targets authors.
4. The Index Copernicus Value is promoted on the website.
5. Description of the manuscript handling process is lacking.
6. Manuscripts are requested to be submitted via email.
7. Rapid publication is promised.
8. There is no retraction policy.
9. Information on whether and how journal content will be digitally preserved is absent.
10. The Article processing/publication charge is very low (e.g., < $150 USD).
11. Journals claiming to be Open Access either retain copyright of published research or fail to mention copyright.
12. The contact email address is non-professional and non-journal affiliated (e.g. @yahoo.com).

Some of the recommendations by (Lalu et al., 2017) can be considered to minimise getting trapped into publishing in bogus journals.

- Publishers, research institutions and funders should issue explicit warnings against illegitimate publishers.

- Funders and research institutions should prohibit the use of funds to support predatory journal publications;
- Make sure that researchers are trained in how to select appropriate journals when submitting their work
- Audit where grantees, faculty members and research staff publish.
- When seeking promotion or funding, researchers should include a declaration that their CV is free of predatory publications.

Having discussed the ethical concerns in detail on various dimensions it becomes imperative to understand the role of COPE on publication ethics.

THE ROLE OF THE COMMITTEE ON PUBLICATION ETHICS (COPE)

COPE and its members since its inception play a major role in addressing the ethical concerns of research and the scientific community. The Committee on Publication Ethics (COPE) which was founded in April 1997 is a non-profit organization with a mission to define best practices in the ethics of scholarly publishing.

Cope encourages editors of peer-reviewed academic journals, companies that publish peer-reviewed academic journals and universities to become an individual or corporate member of COPE. To ensure that the members are sufficiently transparent about their business practices, COPE alongside Open Access Scholarly Publishers Association (OASPA), Directory of Open Access Journals (DOAJ), and World Association of Medical Editors (WAME) has compiled a minimum set of criteria that journals will be assessed against when they apply for membership. Membership in COPE helps individual authors and institutions who are concerned about the ethical dimensions of publishing to be more transparent and adhere to the principles of scholarly publications. COPE members are free to attend annual seminars organised but COPE, seek advice on individual cases via forums, have access to eLearning package, use ethical audit tool to see how well their journal matches the COPE's guidelines on ethical publishing etc., Individual authors too should make efforts to become more aware of the ethical practices of the journal they propose to publish. They can use these criteria for assessing a journal before considering the journal for publication. They can also have access to the COPE's other resources which are available to both members and non-members including the, flowcharts, Core Practices, Best Practice guidelines, newsletters, cases database, podcasts of forum discussions and retraction guidelines.

CONCLUSION

The open access publishing model is an important development in the transfer and sharing of knowledge. Therefore it becomes essential for all the stakeholders including researchers, publishers, universities, funding agencies, institutions like ICAI and COPE along with its partnering organisations to have a shared understanding of what our obligations are in undertaking this research and scholarship. Commercialization of OA has to be evaluated in comparison to non-commercial approaches, including those pursued by the vast majority of OA journals, which do not charge article-processing fees. Publishers need to relook at the criteria for APCs and reduce the charges so that more researchers have equal opportunity and

contribute to the pool of knowledge. It is such an irony that knowledge creators should bear the burden of the complexities in the process of disseminating the same. Researchers too on their part can assess journals for their authenticity before submitting to journals. The cabell's index regularly lists the predatory journals, so does The Directory of Open Access Journals which provides useful information about credibility of OA journals. Assessing on the criteria used by COPE to evaluate journals is also useful. All this can help researchers in identifying the right journal for publication. Institutions and administrators of higher education should also have a more realistic approach to Academic Performance Index and recognize and affirm academic integrity as a core institutional value so that this model is here to stay for the benefit of the academic and research community. As open access publishing is unfolding as a significant alternative in academic publication and radically promising and it is important to nurture it.

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KEY TERMS AND DEFINITIONS

Article Processing Charge (APC): APC is a fee charged to make an article open access on publication. It is the central funding mechanism for open access journals.

Citation Index: A citation index is a kind of bibliographic index, an index of citations between publications, allowing the user to easily establish which later documents cite which earlier documents.

COPE: Committee on Publication Ethics is a non-profit organization with a mission to define best practices in the ethics of scholarly publishing.

Diamond or Platinum Open Access: Journals that do not come with any financial obstacles for authors as well as readers are called diamond or platinum open access.

Double Dipping: When a publisher benefits twice from an author to make an article "open-access." and from a library for a subscription to that journal.

Gold Open Access Model: The publication is freely available on the publisher's website immediately.

Green Open Access: Enables authors to archive their own work on a website controlled by them, or their funder, or on an independent repository.

Hybrid Open Access Journals: Some articles are openly available after payment while other articles remain closed as in subscription-based journals.

Impact Factor: Impact factor of a journal is defined as total number of citations for the articles published in a proceeding 2 years divided by total number articles published in 2 years.

Open Access (OA): Open access is the provision of free and unrestricted online access to research outputs such as journal articles, books, amongst others without the usual subscription fees.

Retraction Policy: The policy of a publisher in retracting a published article: An article may be retracted when the integrity of the published work is substantially undermined owing to errors in the conduct, analysis and/or reporting of the study. Violation of publication or research ethics may also result in a study's retraction.

Chapter 17
Reframing Educational Tools as Open Access and Sustainable Funding Models

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ABSTRACT

The SARS CoV-2 (COVID-19) pandemic drastically forced millions of students, faculty, staff, and administrators into a digital world of the unknown. The unexpected perplexities of these unknown digital environments resulted in unacceptable percentages of student losses in school attendance, student academic performance, and as a result loss to local communities. One perpetual reminder this pandemic taught is that even post-COVID, educational institutions will have to rely upon remote, digital interfaces due to future challenges such as hurricanes, fires, flooding, rolling blackouts, etc. However, each of these barriers also presents new opportunities to learn and provide access to products and services such as hardware and Internet access, which will improve student success and retention.

INTRODUCTION

The SARS CoV-2 (COVID-19) pandemic drastically forced millions of students, faculty, staff, and administrators into a digital world of the unknown. The unexpected perplexities of these unknown digital environments resulted in unacceptable percentages of student losses in school attendance, student academic performance, and as a result loss to our local communities. One perpetual reminder this pandemic taught us is even post-Covid, educational institutions will have to rely upon remote, digital interfaces due to future challenges such as hurricanes, fires, flooding, rolling blackouts… However, each of these barriers presents us with new opportunities to learn and provide access to products and services such as hardware and Internet access, which will improve student success and retention. Some of these new

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opportunities include creating and implementing sustainable funding models that can provided needed hardware and Internet access, reframing the idea of open access to include access to the Internet and hardware, and properly advocating for and obtaining varied types of funding for proper Intranet access and hardware. Many of these types of funding models include reallocating existing educational institutional funding, federal and state grants, private philanthropic funding, and consortia funding. Some entities have already begun to creatively provide funding to expand Internet access and hardware access to impoverished areas, which prevents a future barrier for student learning and education. Many other communities and educational institutions should expound upon these examples and continue to provide adequate access to Wi-Fi and hardware for students, faculty, and staff in need. One of the impetuses that re-highlighted this need of hardware and Internet access was Covid-19.

BACKGROUND

In March of 2020, due to the SARS CoV-2 (COVID-19) pandemic, the world witnessed basketball seasons cancelled while games were in progress. Also, schools, restaurants, retail outlets… all closed within a matter of days around the world, and suddenly, the world's denizens and many of their reliable societal institutions came to a standstill. As a result, educational institutions at the K-12 level and higher education institutions no longer offered in-person instruction, and administrators scrambled to determine how their school staff could continue to offer pedagogy to students in a remote fashion. Educational institution administrators selected Zoom (Zoom, 2021), Microsoft Teams (2021), Google Classroom (2021), Canvas (Canvas, 2021), Blackboard (Blackboard, 2021), and a variety of other digital interfaces and learning management system platforms on which to offer pedagogical materials to students. This dramatic shift from in-person instruction to online instruction exhibited valiant efforts via administrators at local independent school districts, private K-12 schools, and at the college and university levels. However, this swift transition to on-line learning environments presented enormous learning curves for administrators, students, teachers, and staff, which also resulted in many technological barriers (Aristovnik et al., 2020).

MAIN FOCUS - ISSUES, CONTROVERSIES, PROBLEMS

The main issue depicted in this chapter is how the pandemic highlights how virus outbreaks, hurricanes, floods, fires, and other disasters force educational institutions to rely on online learning environments. However, many students do not have access to proper Wi-Fi and hardware to successfully participate in an online learning environment. Therefore, this chapter presents some opportunities moving forward to discover perpetual funding models for newly created open access opportunities that include hardware and Wi-Fi.

METHODOLOGY

The methodology utilized to examine this problem is a literature review. This literature review depicts the problems Covid 19 highlights in regard to students, faculty, and other key stakeholders not having access to reliable hardware and WiFi during the pandemic. This lack of access resulted in numerous

students dropping out of K-12, college, and graduate school programs. This literature provides specific examples of these problems. It then offers solutions to this problem by reframing open access to encompass hardware and WiFi. This chapter further offers sustainable funding models to pay for perpetual access to necessary hardware and WiFi access.

Perplexing Online Environments

Some of the learning and technical obstacles manifested during the pandemic at the K-12 and college levels included students never receiving training regarding how to log-on, interact with learning materials, submit assignments, and further maneuver the online platforms their schools required them to utilize. A plethora of teachers and professors attempting to offer instruction via these platforms lacked knowledge to properly utilize these on-line platforms. Therefore, many students frantically attempted to understand how to complete assigned coursework on foreign online platforms, and faculty attempted to upload, retrieve, and grade coursework on very unfamiliar course sites. Such mass confusion precipitated great losses in student retention at the K-12 and college/graduate levels. Technological barriers also caused losses in student retention.

During the frantic transformation from in-person learning to virtual learning, many educational institution administrators wrongfully assumed students possessed proper hardware, Wi-Fi, or MiFi to access and interact with assigned online educational platforms. However, many K-12 and colleges level students did not have access to laptops, computers, tablets, Wi-Fi, or MiFi at their domiciles, or anywhere near their homes (Said, Refaat, & Thomas, 2021). Thus, in just a few days, thirty percent or more students at some educational institutions were lost instantly, and for some students eventually were lost for an entire academic year, or longer. These students lost, in some cases, an entire year of education due to the lack of access to proper hardware and Internet access. At present day, many of these lost students still have not returned to a proper educational entity (Amelia et al., 2020).

Caveats of the Effects of Student Loss

One example of such student loss is exemplified in the Dallas Independent School District (DISD). During this 2020-2021 school year, due to not having access to proper hardware and Wi-Fi, the DISD testing data indicates students fell behind 50% in mathematics performance and decreased in reading performance by 30% when juxtaposed with their math performance in December 2019. Such academic regression could affect these students academically long term. Additionally, unfortunately, many minority groups are disproportionately affected by these decreases (Brown, 2020). DISD reports serving a high percentage of minority students. Thus, in this particular scenario, minorities were greatly affected by the pandemic and lack of access to necessary hardware and Wi-Fi and MiFi (Dallas Independent School District, 2021).

Another illustration of this conundrum is found at the community college level. Numerous students dropped out of community colleges during the spring of 2020 when the pandemic began. Many of these students still have not returned to their respective community college, thus losing an entire year of potential education. Some of the reasons these students cite for dropped out include not having a laptop or access to Wi-Fi, not being able to complete schoolwork on tiny phone screens, not having home Internet access, and not having access to computers at home (Levin, 2020).

The above-mentioned scenarios exemplify again how minority students are sometimes disproportionately affected by global hardships such as Covid-19 (Feng et al., 2020). A recent study from the Pew Research Center indicates more economically challenged students than ever before are entering colleges and universities in the United States. However, due to limited resources at those colleges and universities, when natural disasters, pandemics, or other unexpected hardships arise, these economically disadvantaged students tend to drop out and not return (Smith, 2019). Such hardship was exemplified at Santa Monica College this past year when a student was trying to complete course work online during the pandemic. This student was trying to complete course work on a smartphone due to not having a laptop or access to Wi-Fi. The library at the community college where she normally studied was closed due to the pandemic. So, she dropped her courses to prevent receiving failing grades (Levin, 2020). Students at four-year colleges and universities also experience negative outcomes due to Covid.

Ultimate Effect on Communities

Many four-year academic institutions spend copious amounts of time recruiting, enrolling, and training students at the undergraduate and graduate level. Upon graduation these students contribute to local economies and provide invaluable services to the community. Some of these services include medical care, law enforcement, education… to name a few. However, Covid-19 disrupted this entire process from recruitment, admissions, enrollment, orientation, retention, and the path to graduation (Ahlburg, 2020). Much of this disruption resulted via a lack of access to computers, tablets, other hardware; and a lack of access to Wi-Fi (Darbishire et al., 2020). Thus, students not only lost a year plus of their academic careers, but now as we approach nearing a post-pandemic society, many job markets opening back up face a lack of trained labor to fill this need. Along with this negative effect on the communities, even post-pandemic schools and communities will face other barriers that force educational institutions to continually rely on remote instruction and interaction with students, faculty, and staff (Anonymous, 2021).

Other Future Impediments to In-Person Learning

Post-pandemic, educational institutions will deal with other barriers to onsite delivery of pedagogy. These difficulties consist of hurricanes, rolling blackouts, fires, flooding… For example, during the pandemic in 2020, the Texas and Louisiana coast delt with multiple hurricanes that caused flooding, which lead to further shutdowns of educational institutions. Because various geographic destinations will have perpetual, unplanned occurrences that result in a lack of access to physical buildings such as lecture halls, libraries, student centers…, higher education and K-12 educational entities must prepare to offer appropriate hardware and Wi-Fi to all of their students. How might an educational institution ensure all its students have such access? They may provide such access by revisiting their spending policy, advocating at the state and federal levels for additional monies via grants and annual budget to support student access to needed technology, seek out philanthropic funding for such endeavors, and re-envision how open access includes hardware and some type of Wi-Fi access.

SOLUTIONS AND RECOMMENDATIONS

An immediate opportunity presented is for college and university administrations to review their means of spending across campus. Universities and colleges receive varied types of funding ranging from state funds, federal funds, local funds, donations, tuition and student fees, contracts, and appropriations (National Center for Educational Statistics, 2021). Many of these forms of revenue may only be spent on specific products or services. For example, monies received to pay salaries of faculty cannot be repurposed to purchase hot spots or hardware for students. However, some forms of university and college revenue may be repurposed. For example, student fees collected may include orientation fees, campus fees, lab fees, environment fees, campus spirit fees, technology fees, library fees, transportation fees, athletic fees, health and wellness fees, and commencement fees (Powell & Kerr, 2021). Many of the challenges highlighted during the pandemic such as not having enough hardware and Wi-Fi access for students also present colleges and universities with an opportunity to address this conundrum via repurposed revenue in the form of student fees (Katz et al., 2021).

Student Fees

One opportunity the pandemic presents is to review which student fees might be reallocated to a technology budget, which could provide for the purchase of a device such as a laptop or tablet for every student, faculty, and staff person at the college or university. Such a reallocation might look different for each educational institution. For example, when forced online during the pandemic many services may have been highlighted as not obligatory that were once deemed necessary to ensure student recruitment and retention. For example, how important are campus spirit fees? Or, more succinctly, if student recruitment and retention are top priorities for a college or university, which fees ensure these two endeavors more, campus spirit fees or technology fees that give students needed hardware and Wi-Fi access? It seems this query posed may be rhetorical in that the ability to perpetually access course sites, course material, communication with a professor… regardless of one's current location, may be more vital to encouraging students to initially apply and commit to a university or college and remain at that institution, than the ability to enjoy a campus spirit fee.

Thus, some overarching themes learned during the pandemic are – what are the most important goals for colleges and universities? Are the most important goals to successfully recruit and retain students? Or are they to provide the best campus student spirit experience, or the best student activities center? Or, are the goals something in-between? If student recruitment and retention are top priorities, what processes and procedures are necessary to reach those goals? Do some of those processes involve ensuring means to pay for all students, faculty, and staff to have access to necessary hardware and Wi-Fi? If so, the reopening of campuses around the world provides an opportunity to review each line item that aligns with specific student fees to determine which could be reallocated to provide for student access to technology that ensures their academic success and ultimately successful retention numbers for the college or university. Another creative opportunity presented to colleges and university post-pandemic is to re-envision how open access is defined

Including Hardware and Wi-Fi in the Concept of Open Access

Universities and colleges typically define open access as free, reusable, digitally available data and information that anyone may access and utilize, copyright-free (SPARC, 2021). This understanding of open access usually encompasses books, articles, videos, artwork, book chapters, architecture, audio-files, and other items found in digital content. These items deemed open access are usually provided via a license that explain exactly how the item may be utilized. Thus, a potential user knows whether he or she can amend the item, relicense the item, sell the item, and how else the item may be implemented. One of the most common licenses utilized to define potential use is Creative Commons Licenses (Creative Commons, 2021). An opportunity for post-pandemic colleges, universities, and research institutions is to now include hardware and Wi-Fi or My-Fi in the idea of open access.

Including hardware and Wi-Fi access tools in the panoply of what is open access creates funding opportunities to obtain such objects and provide them to students, faculty, and staff who need some objects. The open access movement from 2010 until present day, advocated for scholarly articles, book chapters, and books to be made freely and digitally available, especially when the production of those items were federally, or state funded. One of the basic premises behind open access is a patron should not have to pay publication costs (taxpayer money), and then pay a vendor a second time (vendor pay-walls) to access an article, book chapter, or book. To present day, this basic premise and advocacy for open access provides individuals access to information that pre-open access movement, would not have been allowed (Suber, 2012). If open access champions can begin to include hardware and Wi-Fi in their advocacy, this can change the dynamic from having students dropping out of college due to not having access to information via no WiFi, and not having access to necessary hardware (e.g., laptops, tablets…), to students succeeding, graduating, and becoming productive members of society.

FEDERAL AND STATE FUNDED OPPORTUNITIES

In framing open access as including hardware and access to Wi-Fi and My-Fi, this could foster opportunities for colleges, universities, and K-12 educational institutions to receive grants and philanthropic donations to support providing hardware and access to the Internet for all students, staff, and faculty. Juxtaposing this approach to the current method of implementing open access to books, articles…, many grants precipitated from the traditional open access movement. The United States Department of Education created a competitive grant opportunity open to any university or college to apply for a 4.9 million dollar award. In essence, colleges and universities submitted applications describing how they would create a digital program that would offer students free, digital textbooks in targeted substantive areas. The University of California won this grant by proposing to develop free, digital textbooks focusing on technical and science subjects (The College Post, 2018). The University of California also proposed developing a repository called LibreTexts which would house these open access texts and serve "students, faculty and scholars in a cooperative effort to develop an easy-to-use online platform for the construction, customization, and dissemination of open educational resources (OER) to reduce the burdens of unreasonable textbook costs to our students and society." (LibreTexts, 2021). State governments also offer these grant opportunities for open access endeavors.

Many state governments offer open access grants, and universities and colleges also offer internal grant opportunities, as well. For example, the state of Texas Higher Education Coordinating Board of-

fers a competitive grant to faculty across the state of Texas who may submit applications detailing how they will develop courses that allow students to utilize open access course materials rather than having to purchase textbooks (Texas Higher Education Coordinating Board, 2021). The advantage is using open educational resources (open access textbooks…) saves students thousands of dollars and it ensures students have access to textbooks and other course material on the first day of class. At the college and university level $1,000 internal competitive grants exist as well. Texas Woman's University offers a competitive grant to faculty who will agree to create courses that offer students OER course material as well (Texas Woman's University Libraries, 2021).

Federal agencies, state agencies, and universities and college could implement similar programs that provide monetary funding for necessary hardware and Wi-Fi access to students. For example, with some advocacy from university, college, and K-12 administrators, faculty, and staff; the Department of Education could be encouraged to create a competitive grant offering that awards millions to colleges, university system, or independent school districts that fully funds educational institutions in providing ample hardware and Wi-Fi access perpetually. Such a grant funding program could put necessary hardware (laptops, tablets…) and Internet access in the hands of all students, faculty, and staff at universities, colleges, and K-12 institutions. This begs the question, since grants are not perpetual, how do universities, colleges, and other educational institutions create sustainable funding to support perpetual access for students, faculty, and staff to hardware and Internet access?

OER Funding Model

One such sustainable funding model called the Lonestar Education and Research Network (LEARN) could supplement the limitations in the grant funding business model. The LEARN open access model that includes free access to hardware and WiFi for students, faculty, and staff is offered as a business conglomerate model and provides access to Wi-Fi via the LEARN network based in Texas. In 2004, Texas research institutions and health science centers created LEARN as a conglomerate to organize and offer high performance networking in Texas. Recently, the Texas Legislature via Senate Bill 1771 established through LEARN a law that creates high speed Internet access, advanced fiber optic network for research, education, and healthcare throughout the state of Texas. This Internet access is funded via state monies (LEARN, 2021).

During the pandemic, LEARN observed that many schools, libraries, and cultural heritage institutions experienced wide gaps in Internet access for their students and patrons. Therefore, LEARN used its state funds to establish a coalition with the Texas State Libraries and Archives Commission, and various Texas libraries to provide high speed Internet connections for individuals who did not have such access via the pandemic. This endeavor specifically targeted cities with populations of 10,000 or less denizens in order to make a big impact on underserved communities. LEARN targeted three libraries in west Texas and seven in east Texas and offered high-speed Internet access of up to 1G upload and 1G download speeds. Such access offered these libraries and its patrons 10 to 100 times faster Internet service compared to their current speeds. LEARN is looking to partner with more libraries across the state in the future, even post=pandemic (LEARN, 2021).

This LEARN endeavor offers universities and colleges a business model with which to emulate to provide its students, staff, and faculty perpetual Internet access via sustainable funding. By emulating this business model, colleges and universities have several opportunities:

1. Advocate for, receive, and utilize state or federal money to establish its own internal Internet access.
2. Establish partnerships with other universities, libraries, LEARN (or similar organization), other cultural heritage institutions, research institutions to establish perpetual Internet access for students, staff, and faculty.
3. Advocate for, receive, and utilize private philanthropic financial help to establish Internet service that serves multiple universities and colleges.
4. Advocate for, receive, and utilize state or federal funding that establishes high speed Internet access for a conglomerate of community institutions; such as elementary schools, high-schools, colleges, universities, senior centers, religions organizations, community centers…
5. Classify the need for hardware and WiFi, MyFi… as a codified open access need.

Example of How a LEARN Business Model Could be Implemented

One caveat of how such a LEARN business model could be implemented anywhere in the world is to first document a business process. Such a process could initially garner a group of community institutions (e.g., colleges, universities, elementary schools, high-schools, libraries and other cultural heritage institutions, hospitals, community centers…). Next, document a need for high-speed Internet access at these institutions. Such a need could be memorialized by conveying how local hospitals do not have high speed Internet access and thus cannot as effectively conduct quick research during a time of high need (e.g., disease outbreak, large scale community accidents…). A conglomerate could also document how high-speed Internet access could help better retain students at a local college or university if these students had access. Further, the conglomerate of institutions could show how proper funding could benefit all of these institutions (hospital, colleges, churches…) in need at one time. By providing such Internet access, this could attract new denizens to the area, new businesses to the community, it could lead to new groundbreaking research at colleges, hospitals… All these benefits to the community could be included in a proposal to a state or federal funding entity and strengthen a proposal. In essence, this LEARN Intranet access business model serves as a model that could be implemented across the world to apply for, receive and implement federal or private funding in anywhere in the world.

By documenting such a local business model, broader national institutions may utilize this model to provide necessary hardware and WiFi via an open access guise. For example, OpenStax offers numerous free digital textbooks in multiple subjects such as Biology, Calculus, Sociology, History… OpenStax is based at Rice University in Houston, Texas and is funded via university funds and philanthropy world-wide. Some philanthropists that financially support OpenStax include the Bill & Melinda Gates Foundation, the Girard Foundation, Google Inc., the Calvin K. Kazanjian Economics Foundation, the Leon Lowenstein Foundation, Inc., the National Science Foundation, the Valhalla Charitable Foundation, to name a few (OpenStax, 2021). A key to obtaining this foundational support is to show a need that could be met at the educational level. Also, by displaying that if this need was met, it could benefit greater society. Thus, some important factors to building a successful business model to obtain necessary funding to create and sustain access to necessary hardware and WiFi for K-12, colleges, and universities:

1. Show a need for students, faculty, and staff in regard to hardware (laptops, tablets…) and WiFi, MyFi…
2. Define the need in regard to numbers of how many students, faculty, staff actually manifest such a need.

3. Show that if this need is met, it will improve student retention, student graduation rates, student success… Also demonstrate how this need benefits faculty and staff.
4. Highlight the perpetual disruptions that demand remote instruction, learning, interaction in educational institutions (e.g., hurricanes, tornados, viruses, fires…)
5. Frame the solutions in contexts of solutions that have already produced success (e.g., open access endeavors mentioned in this chapter – OpenStax, Department of Education grants, state level grants, SPARC endeavors…). Define success (e.g., student access to information, student retention, student graduation…).
6. Convey the ultimate benefits to communities surrounded by the pertinent educational entity (e.g., more well-trained denizens to fill labor needs, more human capital to help solve community problems and create new innovative technology and services…).
7. Create and convey a plan to show how received funding from private entities, non-profits, government entities will be spent, accounted for, and justified based on obtaining necessary hardware and Internet access (e.g., WiFi…).
8. Frame the need for hardware, WiFi, MyFi… as an open access need. Carefully convey this need as being filled via an open access process.

Community Caveats and a Sustainable Funding Model

Libraries Providing Hardware and WiFi Access

Public libraries recognized the demand for access to the Internet and to hardware during the pandemic. Many of these libraries utilized grant funding or its city funding to pay for mobile hotspots and laptops, which were lent to individuals in rural and low-economic areas (Lee et al., 2020). To lend these devices, numerous public libraries and some academic libraries set up distribution sites in their parking lots. Via these distribution sites thousands of mobile hot spot devices and laptops were lent to patrons in need so that these recipients could complete K-12 or college level course work. This type of mobile hot spot and laptop (other hardware) could be replicated for future challenges such as: widespread fires, hurricanes, future pandemics, widespread ice storms…

Cities Providing Hardware and WiFi Access

One other example of a sustainable business model recently implemented to provide students with needed Internet access is found in the city of Fort Worth's expansion of public Wi-Fi program. The city of Fort Worth, Texas implements a public Wi-Fi program allowing people downtown, and in various other locations within the city to log-on and access the Internet. With the pandemic highlighting the need for students to access the Internet, the city of Fort Worth decided to expand its public Wi-Fi to five neighborhoods where most residents lacked home Internet access. Many of these neighborhoods house K-12 students, and students attempting to attend community colleges during the pandemic but were forced to pause their educational pursuits due to Covid preventing them from meeting face-to-face at school (Fort Worth, Texas.gov, 2021).

In expanding this public Internet program, the city of Fort Worth relied upon data that indicated places with lower income, logistical challenges to obtaining education, neighborhoods with low Internet subscriptions. The city next invested money to install equipment on utility poles that provides Wi-Fi

signals from city buildings and local schools into the nearby neighborhoods. Thus, denizens of these neighborhoods can then access the Internet for free via laptops, smart phones, tablets, and other hardware. Again, as mentioned above, the program managers of this endeavor successfully highlighted the many benefits of this program:

1. Providing access for denizens to attend online classes.
2. Providing digital access to social services.
3. Providing Intranet access to local businesses providing invaluable services to the community.

By extrapolating relevant pieces of the many benefits and challenges mentioned above in the various scenarios (e.g. providing Internet access to students who do not have other access, providing, framing the current challenges for students, clearly conveying logistical monetary solutions for providing Intranet/ hardware access…), any local, state, or regional, or state entity can craft, organize, and successfully present a case for sustainable funding for hardware and Wi-Fi access for a specific educational institution. The guide to making a business case below assists individuals seeking such sustainable funding.

Guide to Making a Business Case for Obtaining Sustainable Funding

In order to ultimately receive sustainable, perpetual, and adequate funding; an entity such as an educational institution must show: 1. An immediate or potential need for hardware and/or WiFi; 2. A lack of funding to meet that need; 3. An internal process and procedural infrastructure that will perpetually support the funding received; 4.Internal processes that will perpetually support the hardware, WiFi… received; 5. Processes that will enable the hardware, WiFi received to benefit a greater community; and 6. A robust means of tracking and conveying the greater benefit to the community over time. Most educational institutions should be able to easily display their immediate or potential need for hardware and/or WiFi.

FUTURE RESEARCH DIRETIONS

The following caveat presents an example of how a university or college can convey a need for hardware, WiFi access; recruit partners to submit a request for funding to alleviate this need; describe the benefits and pitfalls of such funding; select a funding model; develop a roadmap for sustainable funding; submit an application for funding; and implement, review, and revise such implementation. By ensuring each of these steps is well thought out in advance, critiqued, and revised prior to submitting an application for funding, the chances of obtaining adequate funding increases exponentially.

Step 1 - Documenting a Need

The first step in ensuring a higher likelihood of appropriate funding is to carefully examine and thoroughly document the need for funding. To complete this step successfully, school administrators should take an account of how many laptops, tablets, other hardware… they have in stock. They should also document the age and current state of the hardware (note any damage), and make careful note of how many students and faculty will potentially need hardware this term. Honesty is a priority in making these estimations, but also school administrators should carefully research and document their current trends

in increase or decrease in enrollment, what will immediately affect these trends (current pandemics, changes in economy, modifications in demographics…), and then carefully estimate how many hardware devices will be required.

School administrators also need to complete a study that gathers data on how many students, faculty… currently have robust access to WiFi, and how many do not. During this evaluation, administrators should carefully define what is robust access and what is not efficient access. Many neighborhoods offer outdated access to WiFi, however, such access is often not reliable. Thus, these types of networks should be considered when documenting numbers regarding who needs access to a more robust WiFi network.

Additionally, potential factors that could interrupt access to a WiFi network should be considered. Some of these factors may consist of the probability of a natural disaster occurring that could interrupt service (e.g., is the current geographic location susceptible to hurricanes…), is there a current pandemic or threat of one, in there current social unrest in the geographic locations…? All these factors including the number of hardware devices and the number of anticipated students and faculty; data regarding access to robust, reliable WiFi networks; and environmental and social factors that could impact access to WiFi should be carefully documented and reviewed, so that accurate, reliable data can be submitted to support a request for funding for hardware and access to WiFi. After compiling enough data that succinctly conveys the need for funding for WiFi access and hardware, the next step is to recruit partners that also manifest such a need.

Step 2 - Recruiting Partners

The next step in building a solid case for funding is to recruit partners that manifest the same need for WiFi networks and hardware and that are also located in the same geographic area. For example, many small businesses often lack proper access to WiFi. Some of these local businesses may consist of doctor's offices, rehabilitation facilities, daycares, restaurants, or grocery stores. All these small businesses provide vital needs for communities. Other natural community partners may consist of other K-12 institutions, or local colleges and universities; government entities such as local libraries, museums, police stations, fire departments, or local hospitals. By reaching out to as many of these entities who do have a need for improved WiFi or hardware, one is likely to gain a few commitments to become partners in requesting funding. When selecting partners, it is important to recruit other companies, government entities… that manifest similar needs as yours. Having homogenous desires will make a funding request an easier process. After forming a standardized conglomerate of partners, the next step is to ensure all partner institutions maintain congruent understandings of possible benefits to such an endeavor.

Step 3 – Proper Conveyance of Benefits

It is vital for the union of partners to adequately ponder, what are the potential benefits of the implementation of a new WiFi network, and of the reception of new hardware. The benefits should be easy to imagine. These may consist of providing a community with cutting edge communication tools, digital knowledge management capabilities, vital digital storage space, and overall improvement to community operations. Such augmented community operations may consist of faster communication and tracking features for hospitals, ambulatory services, police, and fire stations that could help save lives. Also, better digital tools, digital storage space and organization that would better educational opportunities for the community as a whole. Also, if small businesses are partners, improved WiFi service and access

to new hardware could reduce costs for these local businesses. All these benefits and the vast number of community partners should be ardently highlighted in the funding proposal. After discovering and organizing all of the potential community benefits, the consortium should select the appropriate funding entity from which to solicit funding.

Step 4 - Selecting and Soliciting Funding

In choosing the correct funding entity, the consortium should ensure their needs match the funding entities requirements for granting capitol. Completing applications for grants or funding from philanthropical entities is time consuming and dedicates human capital to such endeavors. It is never a good idea to complete multiple funding applications and hope something sticks. It is much more efficient from a time and employee human capital standpoint to strategically select one or two potential sources of financial backing and focus on those. To ensure one selects the correct source of funding consider the following:

1. What is the overall mission and goals of the funding entity? Does my educational institution's use of WiFi and hardware align with those mission and goals?
2. Is this monetary source's practices, procedures… in line with our educational entities and our partners' ethical practices, values… ?
3. How sustainable is the funding for which each entity is offering?
4. Is the funding unit offering enough money to cover the costs our educational entity manifests?
5. What are the binding laws via the funding agreement to which our educational institution and our partners will be bound?
6. Is there an opportunity for multiple grants of money in the future from this granting source?

Some funding sources to consider when applying for money to cover the cost of WiFi and/or hardware include:

1. Fort Worth, Texas.gov Fortworthtexas.gov/news/2021/05/WiFi-Updatev or other local entities.
2. Federal Government Programs. https://www.cbsnews.com/news/broadband-discount-50-dollar-internet-bill/ (Picchi, 2021).
3. Many Internet providers are offering high-speed Internet https://www.highspeedinternet.com/resources/internet-guide-during-coronavirus-outbreak (Armstrong & Parrish, 2021).
4. The Emergency Broadband Benefit https://www.assurancewireless.com/ebb/ebb-benefits (Emergency Broadband Benefit, 2021).
5. Many states are also offering WiFi funding. https://publicservice.vermont.gov/content/new-connectivity-resources-support-you-during-covid-19-state-emergency-vermont (State of Vermont, 2021).

After applying for the funding, if an entity receives funding, the final step is implementing the funding and iteratively evaluating the new program.

Step 5 - Implementation and Evaluation

The final steps of the process are implementation of the program and an iterative evaluation. In order to successfully implement the program and evaluate it, the consortium should develop and document processes and procedures prior to implementation. For example, who will inventory and how the hardware, or who is using the WiFi and when, is the WiFi working…? Also, how will damage to hardware or WiFi outages be documented and reported to providers? How will accountings be provided to the WiFi provider, and by whom? All of these processes and procedure should be developed and documented prior to implementation. Further all of these processes and procedures should be iteratively evaluated as the program matures. Who uses the WiFi, hardware, how it is utilized, by whom, how long… all should be iteratively evaluated as the program matures? Further, the consortium should always ensure they are in compliance with all mandates in the funding contract. All of these evaluations should be a perpetual and iterative process to ensure legal compliance; maturity of the program; and continued success, improvement, and efficiently for faculty, students, and staff. Below is a listing of where specific additional funding for hardware and WiFi may be accessed.

Specific Locations from Which to Seek Funding for WiFi and Hardware

Individuals may seek funding for hardware and WiFi implementation from a plethora of places. Some locations are listed below:

1. Affordable Connectivity Program and the Emergency Broadband Benefit – Federal Communications Commission https://www.fcc.gov/broadbandbenefit Congress enacted the Affordable Connectivity Program, a new long-term, $14 billion program, to replace the Emergency Broadband Benefit Program. This legislation provides perpetual Internet access for schools, health care facilities, and others.
2. Altice USA offers temporary free and reduced pricing broadband access for K-12 and college and university students during the pandemic. https://www.alticeusa.com/news/articles/feature/corporate/altice-usa-brings-free-broadband-k-12-and-college-students-during-coronavirus-pandemic (Armstrong & Parrish, 2021).
3. Charter Communications https://corporate.charter.com/newsroom/charter-to-offer-free-access-to-spectrum-broadband-and-wifi-for-60-days-for-new-K12-and-college-student-households-and-more This provider offers 60 days of free connectivity. (Armstrong & Parrish, 2021).
4. Spectrum https://www.spectrum.net/support/internet/assistance-communities-need/ Spectrum is offering WiFi hotspot access (Armstrong & Parrish).
5. Comcast https://www.internetessentials.com/ Comcast is offering access to public WiFi hotspots. (Armstrong & Parrish, 2021).
6. Federal Communications Commission is also offering a Lifeline program that provides affordable Internet access for low income earners. https://www.fcc.gov/lifeline-consumers
7. Institutes of Museum and Library Services https://www.imls.gov/grants One may apply for an IMLS grant for hardware and Internet access.
8. United States Department of Health and Human Services https://www.hhs.gov/coronavirus/grants/index.html One may apply for grants during the pandemic from the United States Department of Health and Human Services

9. Bridging Tech provides students with a laptop or other hardware for educational purposes. https://www.bridgingtech.org/
10. Many philanthropic partnerships at the state and federal levels between private donors and government agencies provide opportunities for K-12 and college students to obtain various hardware https://www.govtech.com/network/schools-struggle-to-get-laptops-to-students-during-pandemic.html

CONCLUSION

In summation, the Covid-19 pandemic manifested the realization that many K-12 educational institutions, colleges, and universities were not well prepared with proper hardware and WiFi to support remote student learning and faculty instruction. Even when the Covid-19 pandemic wanes, flooding, hurricanes, fires, and other disasters and health emergencies will mandate remote learning. Thus, the pandemic also highlighted opportunities to evaluate and implement new, sustainable funding models that can support broad reaching WiFi and robust hardware for students, faculty, and staff. Some of these funding models consist of repurposing already existing institutional funds, philanthropic subsidies, governmental grants, internal grants, emergency governmental funding, consortia funding, and other monetary awards. Whatever, the model is an entity or consortium selects, it is vital to document the need, recruit partners in similar circumstances, emphasize the community, state, and broader potential benefits, select appropriate funding, and iteratively evaluate the new WiFi, hardware program once implemented. By following such a roadmap, continuous efficiency and success are more likely.

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KEY TERMS AND DEFINITIONS

Creative Commons Licenses: Provides licenses to authors and creators of work that specific how their works may be utilized, commercially, remixed, distributed, built upon, and copied.

Hardware: The machines, wiring, and other physical components of a computer or other electronic system. Examples are laptops, tablets, smart phones, personal computers.

Learning Management Systems (LMS): A software application or Web-based technology that provides course shells and digital tools (e.g., video production, educational modules, course quiz and test areas, chat features, course calendars…) for online pedagogy. LMS are implemented at colleges, universities, and at the K-12 educational levels. Common examples include Blackboard and Canvas.

MiFi: A mobile device that facilitates wireless access by acting as a Wi-Fi hotspot.

Open Access: Information and data freely available, in digital format, in an online environment. Open access content may be restricted by some type of Creative Commons license, however, is usually less restrictive than more traditional licenses.

OpenStax: This platform is hosted by Rice University, and offers open educational resources textbooks, and other open access pedagogical content.

WiFi: A secured connection allowing computers, laptops, smartphones, tablets, or other devices to connect to the Internet or communicate with one another wirelessly within a particular area.

Chapter 18
Negotiating Open Access:
Ethical Positions and Perspectives

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ABSTRACT

In this chapter, the authors interrogate the discursive terrain of the open access phenomenon to position the processual as well as the discourse communities that open access is inevitably enmeshed in. The essay explores the current climate of open access and investigates the ethical dilemmas that its subversive sibling of guerrilla open access foregrounds. Further, the essay also recommends a viable model that can be deployed by state players as an exemplar of academic socialism that is flexible, accommodative, and a true reflection of the open-access philosophy which also counters the development of otherwise illegal and 'pirate' models of open access.

INTRODUCTION

The purpose of this chapter is to delineate the contours of Open Access practices in academic publishing vis-à-vis its ethical dimensions. The essay positions Open Access not merely as a processual dimension of academic publishing, but as a significant discursive field that inaugurates a wide apparatus for serious academic deliberations. Central to our exploration here is the emergence of the discursive apparatus of civil liberty and its intersectional ethical axes--the State apparatuses, corporations, and Open Access as an episteme--as crucial vectors of Open Access publishing. While most discussions on Open Access concentrate on the financial, academic, and intellectual dimensions, our exploratory essay here draws crucial attention and immense scope in furthering research around civil liberties and ethical dimensions

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in academic scholarship. We demonstrate how the engagement with the discourses that Open Access presents also opens up a field of potentially illuminating deliberations around academic scholarship, ethics, and civil liberties.

We study existing literature around Open Access and outline the significant discourses of ethics that manifest in these explorations. Potentially adding value to epistemologies of internet knowledge vis-à-vis ethics, this essay delineates the different philosophies, policies, and practices of Open Access to generate a network of interlinked social, political, economic, and cultural discourses that can potentially generate the currency of Open Access today. Drawing from the work of Willinsky and Alperin (2011) on academic ethics in the field of research and scholarship and through extrapolation of evaluative ethical models, Open Access practices are scrutinized to ascertain how 'ethical action' can enable a positive action within academic publishing. The essay also makes recommendations and charts directions for institutional and accreditation bodies, higher education institutions, and State actors in generating new knowledge ecologies disencumbered by regimes of monetization and instead, driven by a free flow of global systems of knowledge exchange for the developing countries.

We begin with an explication of the current Open Access policies. Emerging literature points to the presence of several different models of Open Access that are available. The inroads made by the Directory of Open Access Journals (DOAJ), spearheaded by Lund University, are reviewed to position countries and their contributions towards the proliferation of knowledge via Open Access (Sahoo et al., 2017).

METHOD

Beginning with a narrative review design, the essay here explores and highlights crucial concerns with the phenomenon of Open Access. Further, it applies the advocacy research paradigm to emphasize the emerging ethical dilemma and perspectives often not foregrounded in Open Access discourses. Following this, the essay provides a recommendation of an alternate model that is believed to bear fruition of the philosophy of Open Access. The existence of Open Access is scaffolded by mapping emerging discourses built around the prevailing philosophy, legislations, state and non-state actors, and other stakeholders. Similarly, acquiring knowledge about the Open Access phenomenon will not be possible without examining it from the stand points of the diverse ethical positions and perspectives. In this light, specifically, the essay is informed by social constructivism as its ontological stance and interpretivism as its epistemological stance.

TOWARDS AN OPERATIONAL DEFINITION OF OPEN ACCESS

Open Access (OA) has been growing enormously as a significant movement within academic scholarship. One of the significant Open Access statements that has governed the Open Access phenomenon is the influential public statement of the Budapest Open Access Initiative in 2002. This statement prioritizes free availability of research literature on the public internet that provides users permission to read, download, distribute and copy, provided there is proper acknowledgment and citation (Suber, 2012. p7). Similarly, the Bethesda and Berlin statements also echo similar sentiments with qualifying that the copyright holder's consent for the distribution and download should be sought in advance (Suber, 2012. p8). Thereby, the removal of monetary and permission barriers is central to the Open Access philosophy.

While several attempts to define Open Access have been made, it can be concluded that in general, Open Access refers to content that is free for access online with no monetary, copyright or licensing regulations. The philosophy of Open Access is informed by intellectual commons as the guiding principle of scholarly knowledge production and dissemination. However, in most cases, certain restrictions do exist, either in terms of funding, or distribution.

Eve (2016) observes: "For a piece of academic research to be called 'Open Access' it must be available digitally for anybody to read at no financial cost beyond those intrinsic to using the internet; the removal of price barriers. … Open access means implementing a new system that allows free access to peer-reviewed scholarly research on the world wide web" (p. 1). In general, Open Access rests on the premise of the availability of the internet. While Open Access is built on the principle of democratization of education and as antithetical to the corporatization of knowledge production and dissemination, it also stems from the academic's desire to be read.

TYPES OF OPEN ACCESS

Work that is not Open Access and is available for a price is called toll access (TA). The different types of Open Access choices include mostly Gold and Green. Using terminology from the domain of software, Suber (2012) delineates the distinction between green and gold Open Access on the basis of the extent of freedom and the mode of availability of knowledge. He remarks: "The gratis/libre distinction is about rights or freedoms while the green/gold distinction is about venues or vehicles. Gratis/ libre answers the question, *how open is it?* Green/gold answers the question, *how is it delivered?* (Suber, 2012, p. 67 Emphasis in original). See Table 1.

In this distinction, it is important to note that OA delivered by journals is attributed as Gold OA since this often involves some support cost delivered either by the author, the institution, or the funding that makes the research possible. In comparison, green OA is delivered through OA repositories. These

Table 1. Types of open access

		VEHICLES *How is it delivered?*	
	OA Matrix	**Green**	**Gold**
BARRIERS ***How open is it?***	**Gratis**	Self-archiving in repositories	Open Access Journals
		No price barriers	No price barriers
	Libre	Self-archiving in repositories	Open Access Journals
		No price barriers Some permission barriers	No price barriers Some permission barriers

repositories are online collections and databases of articles, some of them institutional, and few others on personal websites of authors. However, while OA journals obtain necessary permissions and rights directly from the authors involved, repositories often warrant that the permissions be obtained by the depositors themselves (Suber, 2012).

The different types of Open Access operational models include those paid for by the author, or their institution. The flip side of publishers reducing author-pay costs to attract authors towards journals that are below standards and with poor services (Gasparyan et al., 2015). In some other cases, external funding is sought from private foundations and grants as an alternative operational model. In some instances, such requirements of Open Access are warranted by the funding agencies themselves (Parker, 2013). In fact, research that is publicly funded, it is argued, should be made freely available to those who paid for it, directly drawing an academic's responsibility towards the dissemination of knowledge and spending public money (Parker, 2016). This ensures that authors are not having to carry the financial burden of publishing. However, this may largely depend on the availability of external funding and may be limited to research in the sciences. Besides, external funding cannot always be a sustained effort since it entails the expiration of validity in many instances.

The third type is the fee-based support model that invites advertisements on the journals, through which the journal costs are often sought to be covered. This has also worked to introduce allied and related research products and services to the academic community and is beginning to function as a more cost-effective model for OA publishing, but it has also come under criticism for commercialising potential OA projects that are themselves built on the bedrock of being antithetical to commercial enterprising in general. Others include voluntary work where researchers work for no remuneration and personal websites where authors make their own publications available for free.

LOCATING OPEN ACCESS TODAY

The Open Access phenomenon has changed the landscape of publishing radically. Walker's study (2002) demonstrates that providing free access to journal articles immediately on publication maximizes their impact. Describing two entomological societies in the US that have profited from publishing their work immediately and for free, Walker demonstrates how immediate free web access (IFWA) enables authors to expand their work's reach with no barriers for readers, dismantling any barrier that may arise with publication time not concurrent with research presented.

Developed to support credible peer-reviewed research through the Open Access route, the Directory of Open Access Journal (DOAJ) was set up as an indexing authority validating high-quality peer-reviewed research whose access is made available for free. It is managed by Infrastructure Services for Open Access CIC (Community Interest Company) based in the United Kingdom (Sahoo et al., 2017). Ideated at the Nordic Conference on Scholarly Communication in 2002, DOAJ was launched in 2003 in Lund University, Sweden, as "a one-stop shop service which made it easier for libraries and aggregators to integrate OA-journals data in their services, for OA-publishers to get their journals visible and for readers to find OA-material" (Sahoo et al., 2017, np).

Given this opportunity to make one's research more visible, and pressured by academic policies of tenure, promotions, and incentives, literature also points to the issue of predatory journals taking over the OA publishing domain, with scholars losing time, money as well as institutional support as a result of such publication practices. These stem largely due to a lack of awareness and vigilance about publishing standards and protocols in journals (Murrell, 2016). Gasparyan et al. (2015) urge researchers, especially in the scientific field, to be aware of such unethical practices and strive to publish in compliance with the standards of publishing ethics.

Neuman and Laakso (2017) study a society journal in philosophy to understand the journal's move towards an independent scholar-run Open Access journal enabling Open Access for its readers. Apart from establishing the strength of making research available for readers freely, Neuman and Laakso also observe how ideological leanings also play a crucial role in determining the choices made towards Open Access. In their evaluation of a humanities journal, they remark:

Regarding the operation of an independent scholar-run Open Access journal within the humanities, one can note that some financial resources are necessary, but above all, a strong community offering its service is important. The Review is … a journal with a strong community. … The need for funding is directly related to the availability of community service, which in turn depends on the community and how editing is valued, and how agents within the community perceive their responsibility for the communication system. … The members of the group behind the Review have thought that the prestige of a journal may depend on clear communication and Open Access editing assistance. i.e., the services provided by a journal are components of its esteem (p. 11)

This dimension of complicating the choice of Open Access also opens immense opportunities to further understand the discursive construction of the Open Access phenomenon.

OPEN ACCESS AND DISCOURSE COMMUNITIES

In this section, we delineate the discursive contours of Open Access publishing. By discourse, we imply the Foucauldian modes and networks that constitute the knowledge of Open Access by drawing attention to the contestations of power that generate the language and currency of Open Access. French philosopher Michel Foucault locates the problematics of power as central to the discursive formation and social thought. Foucault observes: "In every society, the production of discourse is at once controlled, selected, organised, and redistributed by a certain number of procedures whose role is to ward off its powers and dangers, to gain mastery over its chance events, to evade its ponderous, formidable materiality" (Foucault, 1971, p. 53). Drawing from this, understanding Open Access as a discourse entails critically evaluating the means through which the phenomenon constellates into a set of practices ridden by complex vectors that deem our attention.

Canagarajah (2002) delineates the idea of 'discourse communities' that helps further understand the significance of the nodes in the discursive matrix of Open Access. He describes a discourse community as

… a unit at a varying level of magnitude--ranging from theoretical schools within each discipline …. to the disciplinary groups in a single academic institution (such as physicists, sociologists, and linguists ...) and even to the whole of a center as a discourse community (which collaborates in the construction of epistemological paradigms that suit its interest). It is a remarkably fertile term that enables to go beyond traditional domains like 'disciplines' and to connect intellectual activities to larger communities beyond national/state boundaries. It provides an important means of attaining both a micro- and macrolevel perspective on the creation, management and dissemination of knowledge by enabling us to analyze the activity and functions of a discourse community in the context of its geopolitical implications. (Canagarajah, 2002, p. 60)

Therefore, delineating the 'discourse communities' embedded in and responsible for the generation of Open Access widens the scope of exploring discursive vectors of the Open Access phenomenon.

Thus, in negotiating the discourses of Open Access, we are presented with not merely the phenomenon, but the vast contestations of power--social, financial, and cultural capital--that determine the choices and directions of Open Access. Hence, while questions of democratic production and dissemination of knowledge philosophically undergird Open Access, opening up the discursive contours of Open Access also makes apparent the barriers and restraints that disable Open Access from being truly open. Within such instances, questions of ethics become central to further evaluate the apparatuses of Open Access. Who are the primary beneficiaries of Open Access? Is knowledge produced, disseminated and consumed equally across disciplines and across different parts of the world despite access being 'open'? When a radically different take on Open Access via piracy makes its way, how do we locate questions of ethics in such contexts? These are some questions that we wish to explore in the subsequent sections.

Academic Capitalism and Geopolitics of Academic Writing

The contemporary academic publishing ecosystem has radically transitioned to function as a discursive space where several kinds of hegemonic structures and geopolitics are played out. The development of journals and databases that provide access to scholarship has seen a steady increase ever since the digitization of knowledge. Peters M.A. et al., observe:

Digital technologies have significantly contributed to this revolution. Traditional print journals maintained by learned societies had been made available only to individual subscribers and library users. With the advent of information and communication technologies, corporate publishers have acquired and digitalized academic journals. During this transformation, individual subscription and library access have merely moved online, and modes of access have remained, by and large, unchanged. … In the face of lower costs of production, however, corporate publishers have radically raised prices of access. As they have increased their control over knowledge, big publishing houses have become highly profitable businesses. (Peters et al., 2016, p.1404)

In fact, although Open Access is geared towards realizing an idealist goal of ensuring knowledge is disseminated with no obstacles, it is to be noted that journal feasibility via Open Access also rests on several ideologically driven support systems (Neuman & Laakso, 2017). Grant-Kels (2017) contextualises the arrival of Open Access thus:

Requiring access to an article that is not available through one's university library is frustrating. Locating an article on the internet only to find out that viewing and downloading the article requires a charge card is infuriating. At the same time, one needs to realize that publication in subscription journals has hidden costs, including, for some journals, the costs to the authors to produce images in colour. Meanwhile, junior faculty members want to and, for promotion, are required to publish manuscripts in a journal that will afford them the largest audience and the highest chance of being cited. (p.4)

It is in this rather compelling context that Open Access gains ground as a potential solution to knowledge and dissemination. In fact, this emergence can be specifically located within the sciences. In fact, Martin Paul Eve, in his engaged critique of open access and the humanities also observes that

many governments fund Open Access knowledge production in the sciences in order that it will allow industries to benefit from scientific research and bring it back into the public domain of commercial consumption (Eve, 2014, p.23).

This slant towards the sciences and technological corporations in and through Open Access is interesting to note how the building blocks of Open Access were equally initiated by those from non-science disciplines. Paul Eve lists Peter Suber (a philosopher specializing in law as one of the principal drafters of the Budapest Open Access Initiative statement) and Jean-Claude Guedon (a comparative Literature professor) who joined Suber in signing other documents of the Open Access Movement in 2003 (Eve, 2014, p.24). This disciplinary skewness in the production and dissemination of Open Access knowledge is a crucial node to consider the hegemonies of knowledge formation (Parker, 2013).

It is in this context that the essay explores the various ethical dimensions that Open Access inaugurates. To this effect, the essay functions as an instantiation of the critique of publishing ecosystems in general, and the Open Access phenomenon in particular vis-a-vis the discursive terrain it opens up. It points towards several crucial determinants and factors of ethical engagement with information and knowledge dissemination in general and considers Open Access as a mode to enable this in particular (Grant-Kels, 2017).

Guerrilla Open Access: Challenges to Ethical Open Access

While the fundamental philosophy that drives Open Access is equal access to knowledge, Open Access also depends on certain financial models that enable this circulation of knowledge. However, cases like that of hacktivist Aaron Swartz in the USA show otherwise (Murnane, 2014). Evidence to suggest that such parallel, uncomplicated, (however, illegal) modes of enabling knowledge dissemination are popularly accessed and engaged with by the research community is also present (Singh et al., 2021).

As Open Access strives to make knowledge a public good, the operational models of what Aaron Swartz termed as "Guerilla Open Access" (2008) throws light on the manner in which ethics and hacktivism are closely intertwined in the operative landscape of Open Access, otherwise largely confined to conversations about economic models of publishing. Here, it is important to reiterate that devoid of any subscription fee, or fulfilment of any institutional or bureaucratic requirements, such models make knowledge easily accessible in technically illegal terms owing to copyright infringement. Similarly, Elbakyan's Sci-Hub case vs American Chemical Society, Elsevier and Wiley India Private Limited in the Delhi high court for copyright infringement is pending hearing (Singh et al., 2021). Bo-Christer Bjork (2017) terms this "Black Open Access" (p. 173). Bjork also sees the emergence of Black Open Access as a "symptom of a seriously flawed mainstream scholarly publishing model" (p. 175).

Aaron Swartz's case warrants a brief background, especially in the light of discussions around ethics and Open Access. Often hoisted as a mascot of liberating intellectual property from the exploitative economic models, Aaron Swartz, a programmer, and cyber activist was accused of illegally releasing copyrighted academic articles from the JSTOR database. Swartz tragically took his own life in the midst of an ongoing investigation into the accusations. Central to the investigation was the fact that although Swartz downloaded several articles from JSTOR, there was no evidence pointing to the fact that he had in fact shared them.

Swartz's attempt to make publicly-funded knowledge hidden behind paywalls available for free public use (in the now-famous JSTOR case) evidences a spectrum of Open Access conversations that are not merely about the regimes of academic capitalism (Hackett, 2014; Rhoades & Slaughter, 1997; Jessop,

2018) that propel Open Access, but also about semantic nuances in 'ethics', 'piracy' and 'sharing'. In several ways, Aaron Swartz was never seeking to profiteer from the process of making knowledge available to the academic community. In fact, in his now-famous *Guerrilla Open Access Manifesto*, Swartz (2008) observes:

Information is power. But like all power, there are those who want to keep it for themselves. The world's entire scientific and cultural heritage, published over centuries in books and journals, is increasingly being digitized and looked up by a handful of private corporations.

We need to take information from wherever it is stored, make our copies and share them with the world. We need to take stuff that's out of copyright and add it to the archive. We need to buy secret databases and put them on the Web. We need to download scientific journals and upload them to file-sharing networks. We need to fight for Guerilla Open Access. (np)

The emergence of Open Access is also closely associated with the emergence of digitization of knowledge in general, the subsequent resurgence of informational capitalism in particular. Citizens pitted against the State and apparatuses of the State generate a 'cyber war' of the kind where "discernable battles are part of a war or the control and modulation of global society in an informational context in which value is increasingly found in symbolic products and intangible goods" (Silveira, 2013, p. 7).

Yet another significant figure is Alexandra Elbakyan, a doctoral student from Kazakhstan now residing in Russia, founder of Sci-Hub, a repository that also doubles up as a 'pirate website' that provides free access to research articles. Although Sci-Hub faces copyright infringement in many countries, it has seen a steady increase in its visibility and usage. In her presentation at the Open Access Symposium held in 2016 at the University of North Texas, Elbakyan (2016) justified the project of Sci-Hub at hand. She observed that:

... the goal of the project is first and foremost the dissemination of scholarly knowledge in society, and we have to work in the conditions we find ourselves in. Of course, if scholarly publishers had a different business model, then perhaps this project wouldn't be necessary. We can also imagine that if humans had wings, we wouldn't need airplanes. But in any case, we need to fly, so we make airplanes. (np)

Himmelstein et al. (2018) observe: "While the Open Access movement has progressed slowly, Sci-Hub represents a seismic shift in access to scholarly literature. Since its inception, Sci-Hub has experienced a sustained growth with spikes in interest in awareness by legal proceedings, service outages, news coverage, and social media" (p.2). Extending Swartz's Guerrilla Open Access further into a monumental 69% of all scholarly articles with DoI for free access, the question of ethics that Open Access inaugurates becomes sharper and acute. In fact, Himmelstein's research shows that Sci-Hub fetched far more journal articles that were behind a paywall, than those that were available for free through Open Access or green access (Himmelstein et al., 2018, p.11). Interestingly, it is also observed in the same research that Sci-Hub, which previously accepted donations via payment processors like PayPal is now accepting contributions only through bitcoins to avoid government regulations and blockades (Himmelstein et al., 2018, p.12), also making its exponential growth difficult to suppress.

Specifically, these discourses are of significance to academic publishing in countries like India that stands fourth in the list of countries contributing to Lund University's DOAJ (Sahoo et al., 2017), while

also waiting to hear a case against Alexandra Elbakyan, the owner of sci-hub that provides scientific articles free of cost. Such instances turn the focus onto the flipside of Open Access publishing especially by inaugurating an ambivalent take on ethics and academic publishing.

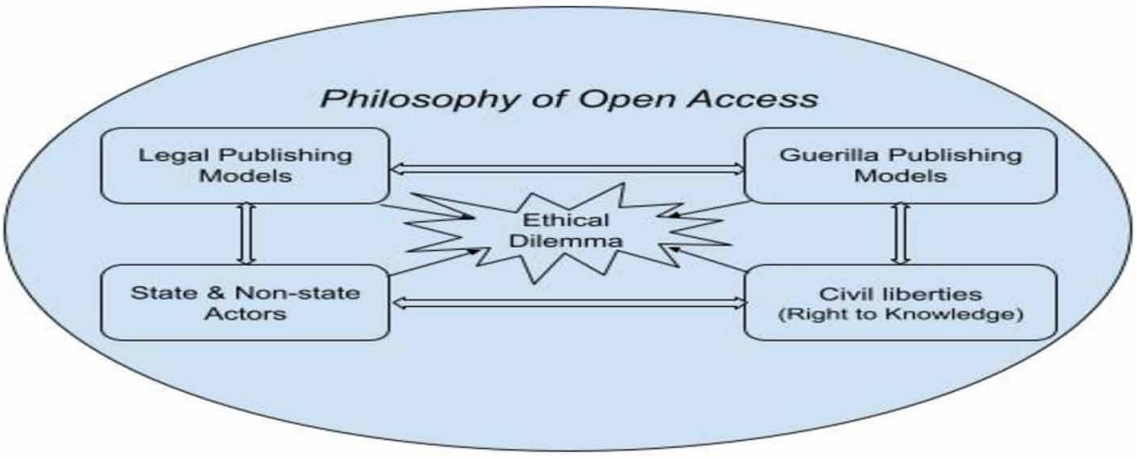
Open Access also ushered in the proliferation of several spurious and predatory journals that compromised standards of knowledge production and dissemination (Gasparyan et al., 2015). To this effect, the Directory of Open Access Journals (DOAJ) streamlined the list of 'legitimate' Open Access publications. Thus, what the discursive field of Open Access opens up are questions of civil liberties, digital rights in the global flow of information, and digital social media movements alongside the role of academic practices and ethics in higher education research and scholarship.

When positioned within the discourses of academic capitalism, these ecologies of knowledge dissemination open up several significant points of departure to establish a strong epistemological terrain for Open Access as a knowledge node. The essay proposes to map the various potential fields of enquiry that can emerge through a close engagement with 'ethics' and civil liberties as being central to any project of knowledge production. Swartz's death or cases slapped on Elbakyan when seen in the light of civil liberties and the need to make knowledge an equally accessible right, points to several grey areas of the otherwise seemingly utopic Open Access phenomenon. Let us look at this a little closely below.

Swartz's and Elbakyan's defense of knowledge as a public good stem from the philosophical import of individual rights and freedom to be accorded to all persons with no barriers. This, especially when seen through the lens of academic scholarship, makes the highly disparate nature of access to knowledge production as well as dissemination evident (recall our earlier discussions on disciplinary, geographical, geopolitical barriers in knowledge formation here).

Thus, as illustrated in figure 2 below, the transactional nature of the discourse communities generates a rich field of potential investigation into academic publishing and civil liberties. While the Green and Gold Open Access models enable a legally acceptable mode of Open Access without infringement of copyrights, it does not ensure access of knowledge to everyone with an internet connection equally. Similarly, while the philosophy of Open Access entails an equal opportunity at access and production of knowledge for all, other discourse communities like State apparatuses, corporations, and academic institutions do not enable this on an equal footing for all. In such a scenario, the subversive Guerrilla or Black Open access enables access to all in the true spirit of Open Access philosophy but is construed to be 'pirate' and 'illegal', and even has ramifications for the civil liberties of cyberactivists who propel this kind of Open Access movements. Within such an intricately woven matrix, how does one truly define what action is indeed ethical and positive?

Figure 1. Ethical dilemma emerging out of the discourse community of Open Access



Ethical Dilemma

In all the cases discussed in the foregoing paragraphs, the civil liberty of ensuring the right to knowledge is upheld while the act of enabling that access is in conflict with the legislated rule of law. This scenario opens up the pandora's box as far as choosing between the ethical positions is concerned. Since the guerilla model of open access, despite being an illegal act, upholds the noble cause of ensuring the civil liberty of the right to knowledge, should this be perceived through the lens of the teleological approach of ethics and deem the act to be ethical or should this be perceived under the Kantian deontological approach of ethics and deem the act as unethical as the means used to achieve the noble end are not noble enough? In fact, Elbakyan (2016) frames this vehemently in her address at the 2016 Open Access Symposium:

The defense of intellectual property on the internet requires censorship of websites, and that is consequently a violation of freedom of speech. This also raises the question of interference in private life--that is when the government in some way monitors users who violate copyright. In principle, this is also an intrusion of communication.

if there is no private intellectual property, and all scholarly publications are nationalized, then all people will have equal access to knowledge." (np)

This line of argument of Elbakyan is further explored in the forthcoming sections while scrutinizing the emerging ethical dilemma in the light of conflicting paradigms of civil liberty and rule of law. The authors of this essay have also attempted in recommending a brief outline of a viable alternate model that shall pave the way for the establishment of academic socialism and thereby realize the essence of true open access.

Open Access and the Indian Context

Of specific interest to the research context here is the popularity and use of Open Access as well as the 'Black Open Access' category in the Indian context. Emerging research points to the fact that India has been making a steady contribution to knowledge in the Open Access category. Sahoo et al., have made a well-defined study about the contributions of India towards Open Access. Their research yields significant research findings that have potential import for our understanding of the Open Access climate within Indian academia. Although representative, their research makes for a strong claim about India as a reckoning force in Basic Science, Medical Sciences, Technology, and Social Sciences (Sahoo et al., 2017). India is ranked 9th with a total of 3.89% of total Open Access journals in the world. Similarly, in another vein, Sci-Hub is also enabling the visibility of Indian research, argues Singh et al. (2021). Their research findings show that "about 90.25% of Indian research papers (for the year 2016) are available in Sci-Hub for free download. … These downloads are distributed to different parts of the world, with major download activity coming from the European region, US, Japan, and Southeast Asia. Further, the paper available in Sci-Hub gets an advantage in citations per paper …" (Singh et al., 2021, p.134).

In such a context, Open Access further opens up vast chasms of academic disequity that can be bridged by Open Access in general, and more robustly by subversive Open Access practices in particular. The fairly complex judicial procedures in the case of Aaron Swartz that inevitably led to him taking his own life, and the 'dynamic injunction' initiated against Sci-Hub and Alexandra Elbakyan by Elsevier, Wiley and the American Chemical Society in the Delhi High Court in India are exemplars of the intersection of civil liberties and rights with academic publishing. Interrogating questions of intellectual property rights, copyrights, and individual civil liberties will open new trajectories as discourses worthy of research. This case specifically will have a long-lasting ramification for research and scholarship in India. This points to the grey areas of ethics within publishing in general and Open Access in particular.

Way Forward

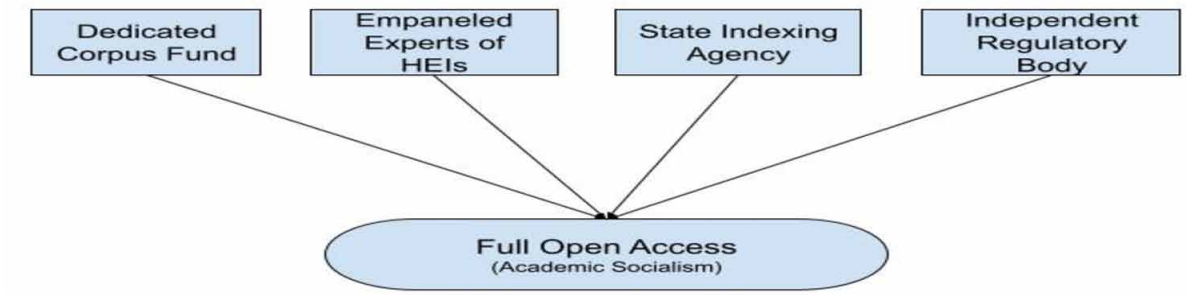
Reviewing the current scenario of Open Access, the prevalence of academic capitalism and its consequences are quite apparent. All the big players among indexing agencies are owned by private companies and it will not be appropriate for the state to expect them to promote Open Access beyond their business interest. Instead, those governments wishing to develop innovation and technology should strive to achieve the same through well-designed policy initiatives. However, the disturbing fact is that even in the national policies for developing innovation and science, most of the developing countries are only focusing on getting access to internationally peer-reviewed indexed journals. Either they lack a clearly defined science policy or it identifies a 'One nation, one subscription' policy as mentioned in the Science, Technology, and Innovation Policy drafted by the Ministry of Science and Technology, Government of India (Government of India, 2020). Obtaining access to peer-reviewed research articles may yield dividends only in the short term.

Alternate Model: Unless a formidable system for indexing research articles is set up to function as an independent regulatory body funded by the state exchequer, the goal of having Open Access will just remain a dream. The authors of this paper felt that the realization of the dream of having truly Open Access will not be feasible without establishing a conducive environment for the same. Firstly, the finance aspect of establishing an infrastructure with effective expertise has to be set in place. Like the coming together of the BRICS nations to fund their developmental requirements, the nations aspiring to promote

science and innovation shall come together and establish a dedicated corpus fund on the lines of the New Development Bank to fund this initiative. Secondly, the effectiveness of this initiative will be determined by the effectiveness of the expertise of the Reviewers and the Editors empanelled for this task. This is the most crucial prerequisite for this initiative. The scientific community of all the partnering nations shall collaborate and equally contribute to setting up this elite panel of reviewers and editors.

Another most important prerequisite is the indexing agency established out of the dedicated corpus fund that shall pave the way for establishing academic socialism. It can even be established as a corporation to tap on the experience of the well-established private indexing agencies of the world to start with. Finally, in order to infuse the much-needed autonomy to preserve the integrity of the academic and research endeavours, the administration and management of all these prerequisites have to be entrusted in the hands of an Independent Regulatory Body. Incorporating a dedicated corpus fund to establish the infrastructure for a public-funded indexing agency which makes use of the expertise of their Higher Education Institutions for the review of the research articles and essentially administered through an independent regulatory body as depicted in figure 2 will take knowledge production and dissemination one step closer to enabling a level playing field in academia globally. This proposed model could eventually replace academic capitalism with the most desired realm of academic socialism.

Figure 2. Prerequisites for full open access



CONCLUSION

We have delineated the discursive terrain of the Open Access phenomenon to inaugurate an engagement with ethical dilemmas that point in new directions for Open Access philosophy. In pointing towards the strengths of both Open Access and its subversive avatars like Sci-Hub, the essay also grounds the domain of ethics as being central to publishing in general and open access in particular. The essay has outlined the various discourse communities that render Open Access in its ideal sense largely impossible to be realised. The contributions made by the 'Guerrilla Open Access' platforms like Libgen and Sci-Hub in this regard draw attention to the need for a strong sense of Academic Socialism that is conceived globally with States acting in the interest of each other, and humanity at large. This is especially required for developing economies like India where the scope and possibilities to generate radical changes within academic publishing are immense. Sci-Hub is poised to alter the publishing landscape for good. Unless more productive and accommodative monetary models are strategically deployed especially through State-driven actors, scholarly work will continue to be liberated from the underground.

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Afterword

This collection of work is a stellar example of how open access improves scholarly communication. The authors bring the most important and challenging issues for consideration and keep the global aspect as a focal point. Well done, bravo!

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