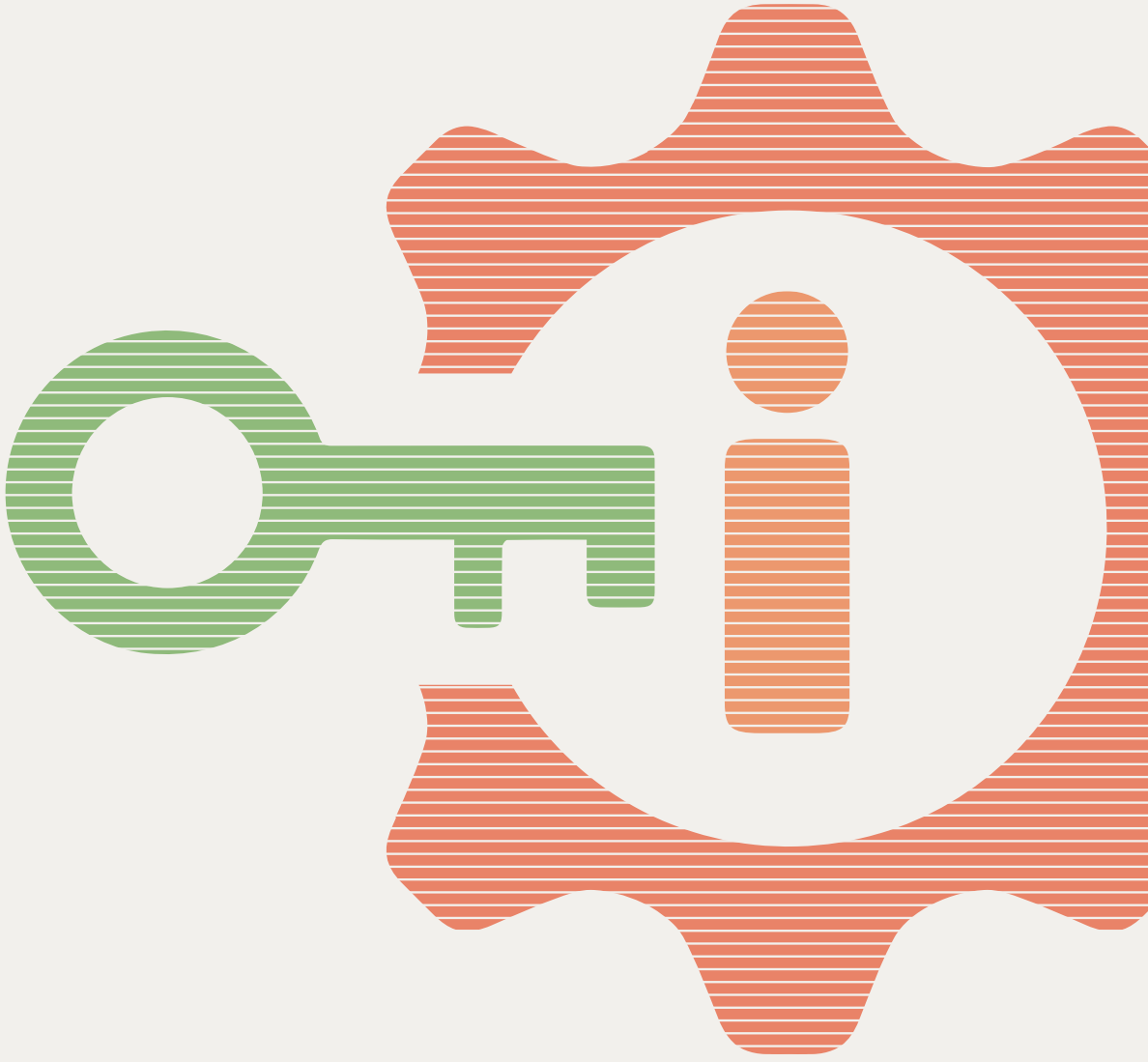
Development and Access to Information 2017

Development *and* Access to Information

2017



IFLA

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TECHNOLOGY &
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UNIVERSITY of WASHINGTON
Information School

IFLA in partnership with the Technology & Social Change Group

The International Federation of Library Associations and Institutions (IFLA) is the leading international body representing the interests of library and information services and their users. It is the global voice of the library and information profession.

The Technology & Social Change Group (TASCHA) at the University of Washington Information School explores the design, use, and effects of information and communication technologies in communities facing social and economic challenges. With experience in over 50 countries, TASCHA brings together a multidisciplinary network of researchers, practitioners, and policy experts to advance knowledge, create public resources, and improve policy and program design.

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Foreword

Around the world, every day, libraries are giving people access to the information they need to live, learn, create, and innovate. From the grandest institutions in the world's greatest cities, to the mobile libraries plying rural back roads, they know that this access empowers individuals, communities, nations and organisations to make better decisions, and live better lives.

This is the argument that we, and many other colleagues, brought to the United Nations as Member States debated the Post-2015 Agenda. The implication, for us, was clear. The Sustainable Development Goals, as they became known, had to include access to information. We are grateful to them for their efforts.

We are glad to say that the UN's Member States shared this understanding, and included access as a specific goal, as well as important targets around Internet access, safeguarding heritage, and universal literacy.

The priority now is implementation.

Maintaining the momentum towards greater and more meaningful access to information will require time and resources. Governments, businesses, civil society, the technical community and researchers all have a responsibility to act.

We are proud that IFLA is taking its role here seriously. It has signed agreements with representatives from over 70 countries to promote the SDGs, and ensure that National Development Plans include access to information and draw on the contribution that libraries can make.

In order to help other relevant actors to design and implement the right laws and programmes, as well as to understand their impact, baselines, indicators, and examples of good practice are necessary. In short, good policies for access to information require good information.

This report does just this, fulfilling a commitment made in the 2014 Lyon Declaration on Access to Information. The result of a close partnership with the Technology & Social Change Group at the University of Washington Information School, it underlines the contribution that access to information, and libraries as key providers of this, make to development.

While the ability of our institutions to improve the lives of our communities is what motivates us and IFLA's members to do our jobs, the research presented here offers an exhilarating insight into quite how broad, and how significant, this contribution is. Importantly, it makes this message clear and accessible for all. There can be no excuse for leaving out access to information when designing policy for sustainable development.

IFLA and its members stand ready to work with governments, international organisations, and funders to make this happen.

Donna Scheeder, *President, International Federation of Library Associations and Institutions*

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Executive Summary

Access to information (A2I) is not an end in itself, but rather a driver of progress across the board. It empowers people and communities, laying the foundations for equality, sustainability, and prosperity. It provides a clear illustration of the rights-based, holistic approach to development taken in the 2030 Agenda.

At the national level, governments, businesses and philanthropists have long invested in access to information in a range of areas – public health, education, research, media, and institutions such as libraries. In 2015, the UN's Member States made A2I a specific target under Goal 16 and also incorporated elsewhere in the 2030 Agenda. Yet investment is not always coordinated, and at a time of competing priorities, it is vital not only to maintain support, but to increase its effectiveness.

This report, the first of a series, sets out the contribution that meaningful access to information can make to development, with a particular emphasis on the focus SDGs at this year's High Level Political Forum. It also strengthens the measurement effort around Goal 16 by establishing a basket of indicators and a baseline.

Future editions will continue to combine thematic analysis with the tracking of progress in order to show how access is advancing, and to identify where there are examples of good practice from which others can learn. This will provide governments, NGOs and other development actors with an effective tool for promoting meaningful access to information for all.

Dimensions of Meaningful Access to Information – Setting a Baseline

As a means of allowing people to find and share information, the Internet will undeniably be central to achieving Goal 16. Its architecture, crucially, not only opens new possibilities to apply and use information, but also invites users to develop and share their own expertise.

However, this promise can only be delivered if the necessary infrastructure is in place, and if people have the devices necessary get online. While half of the world's population do have the possibility to get online, achieving Internet connectivity targets for 2020 remains ambitious, and affordability remains an important issue. Access via mobile devices is likely to play a major role in poorer countries, which has implications for the way in which information is accessed by their populations.

In 2015, the UN's Member States made A2I a specific **target** under **Goal 16** and also incorporated elsewhere in the 2030 Agenda.

Nevertheless, access needs to be about more than computers and cables to be meaningful. Locally relevant content needs to be available, in local languages. Without this, there will be less reason to go online in order to learn or seek information. It is already clear that levels of use of news and similar sites remain lower in developing countries than in developed ones, where more local content is available.

Moreover, it also needs to be legal to create and access information in the first place. The majority of the world's Internet users still face restrictions to their freedom of expression and right to seek information, additionally, there is still a gender digital divide, due to a mix of cultural and skills-related factors.

Finally, even when there is physical connectivity and relevant content, this is meaningless if users are unable to apply it to real-world problems. They need the skills and attitudes necessary to find and use existing information, and create new information which they can share with their communities. Yet it is in the poorest countries that the ability to use productivity-enhancing digital tools is least developed.

In short, meaningful access to information requires four key elements:

1. Information and communications access infrastructure

2. A positive social context for use

3. Sufficient capabilities in communities and their members

4. A favourable legal and policy landscape

The set of baseline indicators provided in this report will help track progress in each of these fields over time.

Libraries: A Development Partner at All Levels

If adequately supported in terms of connectivity, resources and legal frameworks, libraries can make a real contribution to development by providing access to information. At the global level, they are the backbone of innovation systems, supporting the research that allows for better decision making in governments and in international organisations. At the local level, they provide a safe, community-focused space for users to access and put information to work in a meaningful way.

A common theme in the report is the importance of partnerships. Here too libraries have a role. Within government, implementation efforts across policy fields will need to be coordinated. Outside of government, research centres, businesses, local authorities, civil society, educators, engineers and technical experts will need to come together. Libraries can be an incubator for partnerships between different stakeholders at a local level, drawing on their own deep understanding of their communities' needs in order to deliver meaningful access to information.

Libraries can make a real **contribution** to development by providing **access to information**.

Access to Information and Key Sustainable Development Goals in 2017

The benefits of meaningful access in four of the focus SDGs at the 2017 High Level Political Forum are clear.

In the field of agriculture (SDG2), better information can support farmers throughout the cycle, from choosing which crops to grow, which techniques to use, and when and at what price to sell their products. As an often-isolated population, with strong local characteristics, the need to tailor access to needs is particularly important.

With climate change leading to less predictable weather patterns, the gains in resilience and productivity that come from improved access to information will be essential for ending hunger.

Access to information will also improve decision-making on health (SDG3). At the global level, wider and easier sharing of medical research information has been a key pillar of the response to the Ebola outbreak. At the local level, investments in public health information have been shown to repay themselves many times over. Given the sensitivity of the subject, the safe space provided by libraries can prove indispensable for those who might otherwise be afraid to seek information or ask questions, in particular amongst more vulnerable communities.

Women in particular stand to benefit from improved access to information (SDG5), both in terms of taking their place as equals in economic and civic life, and in fulfilling more traditional roles in their families and communities. In many situations, they have not had the same educational opportunities as men, and need additional support in getting online and making use of the resources available. In male-dominated societies, libraries may indeed be the only place where they can access the technology and training necessary, as in the case of Chile's Infocentros.

Finally, access to information can contribute to more effective infrastructure and innovation systems (SDG9). With a growing number of active researchers in the world, and ever more powerful analytical tools, once information is made accessible it can become the raw material for new ideas, products and services. The experience of the Human Genome Project shows that openness is a driver of, and not a threat to, investment in innovation. Similarly, enhancing access to, and use of, information around infrastructure is providing solutions to congestion and poor quality of life in the world's cities.

In all of these areas, access to information can create a virtuous circle. An information-empowered society is better placed to create and share data which can further drive improvements in agriculture, health, economic empowerment, efficient infrastructure and innovation. But delivering meaningful access itself will need to be a team effort. Laws, regulations, investments and infrastructure will need to align, and global, national and local efforts will need to be coordinated. A well-supported library sector will play a major part in delivering success.

Access to Information and the Sustainable Development Goals

Maria Garrido, Michelle Fellows
Technology & Social Change Group, University of Washington

We are determined to take the bold and transformative steps which are urgently needed to shift the world onto a sustainable and resilient path. As we embark on this collective journey, we pledge that no one will be left behind.
United Nations General Assembly (2015)

Can access to information create more socially and economically inclusive societies? Given the unprecedented ability we have today to gather, use, create, and exchange information, how can we capitalize on the strengths of the information society to help combat poverty and inequality, make governments more transparent and accountable, improve gender equity, increase youth's social and economic participation, and promote civic life in our communities?

These are not new questions. For decades, government agencies, practitioners, and researchers have applied information and communication technologies (ICTs) to solve community-level and national-level problems.[1] Over the years, they have amassed extensive evidence on how information and communication resources can be leveraged across highly diverse contexts and a wide variety of domains (e.g., education, workforce development, gender equality, health care, and governance) while employing a range of technologies (e.g. community radio, mobile cooperatives, software applications, and telecenters). Yet despite the lessons learned, we are still far from achieving a truly inclusive information society. It would be a mistake to assume – in a world increasingly driven by interconnectedness, immediacy of information, and ubiquitous communications – that everyone can get online, just as there is no guarantee that broad access to so much information will ensure that it is used in ways that lead to more desirable social goals.

What is holding us back from building an inclusive information society that puts "the world onto a sustainable and resilient path"? Some of the challenges run deep, rooted in social and economic inequalities that surface as obstacles to basic connectivity, digital literacy, and technology affordability. Other emergent and rapidly shifting challenges include security and privacy issues, the explosion of mobile devices, and the disruption of traditional publishing and distribution systems. As our information ecosystem continues to change and evolve, the array of new challenges expands: lack of access among segments of the population, lack of connectivity in rural areas, monopolization of information access and curation, lack of mobile information literacy, and restrictions on freedom of expression, among other issues. In all countries, at all socioeconomic levels, the fight for the right to information is more pressing today than ever.

It is precisely in this complex information landscape that the United Nations agreed in 2015 on a new comprehensive framework: the 2030 Sustainable Development Agenda to end poverty, protect the planet, and ensure prosperity for all. To achieve these aims, the agenda outlines 17 Sustainable Development Goals (SDGs) in areas including poverty, health, agriculture, gender equality, innovation, and youth employment, with specific targets for each goal, and 169 targets in total. Within the SDGs framework, access to information and communication technologies underpins the achievement of the development goals. Eleven targets present access to information as a key tenet for achieving the targets' aims (See Table 1). The agenda differs dramatically from its predecessor, the Millennium Development Goals, in that it takes a rights-based approach to sustainable development. It acknowledges that sustainable development is multifaceted and that all its constitutive components are interrelated. Therefore, to address development challenges, it requires addressing all types of rights – social, economic, cultural, political, civil, and informational (Gigler, 2011; Souter, 2016; Esterhuysen, 2016).

A rights-based approach to information access recognizes that access is only one aspect of the human right to be informed; other dimensions (the ability to create, use, understand, and share) must also be considered before the right can be exercised. We argue, as the Association for Progressive Communications does for ICTs, that the right to information affects all other rights as well. Human rights are all interdependent and indivisible.

Table 1: Access to information codified in the SDGs targets

Goal 1: No Poverty

1.4. By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services.

Goal 2: Zero Hunger

2.c. Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility.

Goal 3: Good Health and Well-Being

3.7. Ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programs.

Goal 4: Quality Education

4.4. Substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship.

Goal 5: Gender Equality

5.b. Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women.

Goal 8: Decent Work and Economic Growth

8.5. Achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value.

Goal 9: Industry, Innovation, and Infrastructure

9.5. Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries

9.c. Significantly increase access to information and communications technology and strive to provide universal and affordable access to the internet in least developed countries by 2020.

Goal 12: Responsible Production and Consumption

12.8. Ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature.

Goal 16: Peace, Justice and Strong Institutions

16.10. Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements.

Goal 17: Partnerships for the Goals

17.6. Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation.

We can all agree that access to information, in all its dimensions, is a fundamental ingredient in the struggle to achieve more inclusive societies. However, we must not overlook the critical role of those who effectively translate that information into accessible knowledge and purposive use. Traditional media, civil society organizations, and public institutions such as libraries have performed this critical intermediary function by curating information, extending informational resources to communities in need, and offering social spaces for convening, learning, creating, and problem-solving in their communities. Such actors have been tremendously important in shaping the ways individuals interact with and apply information, while also helping communities leverage their knowledge and skills toward positive ends such as educational achievement and stronger civic participation. As such, libraries can act as agents of change to advance the SDGs.

The DA2I lens: A framework to analyze the SDGs

Development and Access to Information (DA2I) is a joint project between the International Federation of Library Associations and Institutions (IFLA) and the Technology & Social Change Group (TASCHA) at the University of Washington Information School that aims to demonstrate how access to information and libraries contribute to the achievement of the UN Sustainable Development Goals. This project was conceived as part of the Lyon Declaration on Access to Information and Development, which calls on global institutions and associations to "ensure that everyone has access to, and is able to understand, use and share the information that is necessary to promote sustainable development and democratic societies."[2]

Throughout this report, access to information is defined as *the rights and capacity to use, create, and share information in ways that are meaningful to each individual, community, or organization.* The ability of information access to contribute to sustainable development is influenced by a combination of structural factors (e.g., policies and physical infrastructure) and human/social factors (e.g., usage, population characteristics, and skills). Therefore, we propose a *DA2I framework* to describe four interdependent dimensions that influence access to information and its ability to advance the SDGs:

1. **Information and communications access infrastructure:** the connectivity (and material resources) that establishes the physical connection to information.

2. **Social context of use:** the variety of local, cultural factors that shape the way users will engage with information.

3. **Capabilities:** the body of functional knowledge, skills, and resources a population develops over time that shapes the nature of how information is used or not used.

4. **Legal and policy landscape:** the policies and regulatory frameworks that promote or hinder connectivity, affordability, inclusiveness, and rights. (E.g., spectrum management, universal access funds, copyrights, freedom of speech, privacy, and security.)

The DA2I framework is substantially informed by Burnett & Jaeger's (2005) Information Life Worlds, combined with elements from UNESCO's Media and Information Literacy Assessment Framework. The DA2I framework also reflects a general consensus among practitioners, researchers, and informed policymakers that access to technology alone is not enough to build inclusive and participatory societies. The social context of adoption and use of information is key to unlocking the transformational nature of these resources for improving the well-being of individuals and their communities (Institute of Museum and Library Services, 2012).

Additionally, factors such as access to education, fair housing, decent jobs, affordable health care, and cultural norms around gender and minority groups determine not only the ability of people to access information, but most importantly their capability to use it in ways that are meaningful in their everyday lives. Furthermore, the myriad policies that regulate information access – such as the development and use of the communications infrastructure and the rights of citizens to freedom of expression, association, and discussion – set up the rules of engagement for different actors. This strongly influences whether and how access to information materializes for positive social ends.

The DA2I framework captures the multifaceted and interdependent dimensions of access, providing an opportunity to systematically examine the SDGs through the lens of access to information. It also provides a model for understanding the bidirectional relationship between achieving SDG targets and meaningful access to information – the gains go both ways. Access advances the SDGs, and achieving the SDGs advances access. Progress along the four dimensions outlined above is a bellwether for progress toward both the SDGs and meaningful access to information. The DA2I framework also applies to libraries, particularly as they situate themselves and their services within the universe of access to information and make choices about how to leverage their position in a meaningful way for their local communities.

To recap, the DA2I framework is built on a large body of research that identifies four dimensions that influence meaningful access to information: technical infrastructure, social context, user capabilities, and the legal and policy landscape. This framework provides useful insights for analyzing the interdependent variables that shape access regardless of the unit of analysis. It can be applied to a group of people, to a nation, to the planet. While there are limitations when applied to

increasingly larger scales, there are benefits as well. We believe it is a useful tool for considering access to information in the context of the SDGs.

Structure of the report

This report is the first in a series of annual Development and Access to Information (DA2I) reports that will monitor the impact of access to information on a number of relevant SDGs and related targets. The overall objective of these annual reports is to bring together different voices to show the importance of access to information, in all its dimensions, in promoting more socially and economically inclusive societies. In order to accomplish this, this report will:

- Establish a baseline of access to information indicators to track progress over the lifespan of the SDGs Agenda (2015-2030).
- Examine the different ways in which access to information and libraries are contributing to advancing the SDGs, focusing specifically on the priority areas identified by the High Level Political Forum in 2017.

The purpose of this effort is to draw attention of UN member states, intergovernmental organizations, funders, civil society groups and other stakeholders working in development, and the library community itself, toward the valuable contribution information access makes to development, and to highlight examples of how libraries are successfully supporting the achievement of the SDGs.

The primary objectives of the project are as follows:

- Demonstrate how access to information contributes to development, and how it is embedded across the UN 2030 Agenda;
- Demonstrate libraries' contributions to providing equitable access to information in the context of the UN 2030 Agenda;
- Raise the visibility of libraries within the context of development agendas, particularly the UN 2030 Agenda;
- Serve as a tool to engage access-to-information campaigners, organizations, and libraries at the national level to generate conversations around the contributions of libraries to development.

The report is structured in the following way:

Chapter 1: **The State of Access to Information and Development in the UN 2030 Agenda**

The purpose of this chapter is to introduce a set of indicators that will serve as the basis for the DA2I project, now and through 2030, to track global and regional changes in development and access to information. Using these indicators, the chapter describes the state of access to information as of 2015 in four sections, each of which correspond to a dimension of the DA2I framework: infrastructure, the social context of use, capabilities, and the legal and policy landscape. The chapter also includes a discussion of measurement gaps that must be addressed in order to improve international monitoring and paint a clearer picture of our progress toward achieving the SDG targets.

Chapter 2: **Libraries as Agents for Sustainable Development**

The library is an institution that meets people's information needs. That has been its role historically: providing a place for people to visit, ask questions, and access and use information resources. In doing so, libraries have long played a role as an enabler of individuals in their paths for lifelong learning. The public library, the focus of this chapter, is a community institution, and has the added role of meeting community-wide needs. By applying their inherent resources – including technology infrastructure, knowledgeable staff, and social space – public libraries are able to offer a range of services that address the economic, health, educational, and civic needs of their communities. In doing so, libraries can support the SDGs by acting as agents of change at the local level.

Chapter 3: **A2I for Sustainable Agriculture**

Access to information has a critical role to play in achieving the targets of SDG2. Many farmers, and particularly those working on smallholder family farms, lack access to information on modern farming methods, appropriate inputs (e.g., seeds and fertilizers), market opportunities, prices, and weather forecasts. They may also be unaware of relevant agricultural laws, environmental regulations, and subsidies that could influence their farming practices. Meanwhile, governments, NGOs, research institutions, and others could use open data that smallholder farmers provide to make positive contributions toward ensuring food security, while also holding each other accountable for SDG2 monitoring. This essay highlights twelve A2I initiatives that helped improve agricultural production and farmer livelihoods.

Chapter 4: **A2I for Better Health**

As the UN aims to secure healthy lives and promote well-being for everyone, at every stage of life, access to information on health research, health education, and public health data are of prime importance. But such information contributes to health and wellness only when it is mobilized appropriately: the right kinds of information, engaging the right kinds of users, under conditions that allow it to be used appropriately and trusted accordingly. As such, libraries can play a crucial role in public health initiatives by facilitating digital access, ensuring the quality of health information, promoting and enhancing health literacy, and providing community spaces for people to safely gather information and share ideas. This essay provides some examples.

Chapter 5: **A2I for Gender Equality**

The benefits to girls and women of increased access to information are myriad and far-reaching. However, numerous obstacles hinder their quest for information, including socioeconomic, cultural, and political constraints. This essay provides examples of best practices in information provision for and utilization by girls and women, with particular emphasis on the multiple ways libraries in developing countries are assisting gendered access to information.

Chapter 6: **A2I for Sustainable Infrastructure**

Businesses and governments need information to innovate, and the momentum created by innovations can contribute to the development of healthy, sustainable, and economically vibrant societies. This essay demonstrates how open data and information have provided an underlying infrastructure tapped by the public and private sectors to develop more efficient infrastructure, improve research and innovation, ensure greater accountability, and support a more informed citizenry.

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End Notes

[1] There is an extensive and well-established body of research committed to studying the contributions of access to information for the purpose of advancing social and economic goals. Numerous studies in the fields of communication, particularly development communication (for example, Castells, 1996; Melkote, 2000; Wilkins, 2000; Castells, Fernandez, & Sey, 2009; Toyama, 2011; Heeks, 2010) and information sciences (for example, Burnett & Jaeger, 2011), have shed light on different ways in which communities, civil society organizations, governments, and international bodies used a variety of information and communication resources to advance social change.

[2] For the full document, visit http://www.lyondeclaration.org.

Chapter 1:
The State of Access to Information and Development in the United Nations 2030 Agenda

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Introduction

This chapter examines how access to information can advance the United Nations Sustainable Development Goals (SDGs). For the Development and Access to Information (DA2I) project, we define access to information to encompass the rights and capacity to use, create, and share information in ways that are meaningful to each individual, community, or organization. While the value of information access has been demonstrated in many settings, the adoption of the UN SDGs and the corresponding UN 2030 Agenda provides an opportune moment to consider the broader relationship between information and development.

For this project, we systematically selected 17 indicators, embedded in SDG targets, that correspond to the four dimensions of the DA2I framework – infrastructure, capabilities of use, the social context of adoption, and the legal and policy environment – to highlight the ways that access to information contributes to development. (See Table 1.1 for the list of indicators grouped by DA2I dimension.)

Together, these indicators comprise the DA2I baseline that we will track over the period of the UN 2030 Agenda. By monitoring these indicators over time, our goal is to reveal ways that access to information can contribute to sustainable development.

When individuals and communities develop the skills and resources to obtain, share, create, and express information, they are building powerful mechanisms to address the challenges that are most pressing to *them*. By promoting access to information, we strengthen a bottom-up mechanism for development that is fundamentally community-centered, customized, and localized. This is a powerful lever for progress on the SDGs generally, and specifically on the targets that are most meaningful to communities and individuals. Policymakers and development practitioners should take notice.

Research approach: Operationalizing the DA2I framework

The research process consisted of analysis to support development of the indicator baseline; stakeholder consultations; data analysis strategy (curation, processing, and analysis); and country classification.

1. **Indicator research.** We began with an extensive review of existing indicators from three dozen international organizations that research and monitor development-related indicators, such as the International Telecommunication Union (ITU), World Bank, and UN Development Programme.[1] The resulting collection of 300 potential indicators was then culled according to several criteria, including geographical coverage, recency and frequency of data collection, relevance, and availability. Table 1.1 provides a list of the indicators selected for the baseline. Appendix 1 summarizes our methodological choices, selection procedures and sources.

2. **Stakeholder consultations.** Representatives from the UNESCO Institute for Statistics, NGOs, and the International Federation of Library Associations and Institutions met with DA2I researchers to discuss the project. (See the acknowledgements page for a comprehensive list of stakeholders consulted.) The consultations were instrumental in guiding the project's approach to baseline indicator selection and data analysis.

3. **Data analysis strategy.** After selecting indicators, we amassed and processed a large body of data associated with the indicators. The variety of data sources, data types, and data collection strategies introduced comparison challenges. For example, the datasets often depicted inconsistent geographies, categories, definitions, and time periods. We tackled the inconsistencies on a case-by-case basis and documented our approaches in Appendix 2.

4. **Classification**. Global data is presented by region, applying the regional groupings used in the UN SDG report, or by income group, applying World Bank income group classifications. Country-level data is presented in instances when the associated indicator was collected in a subset of countries, such that regional grouping of this smaller number of countries would not be representative of that grouping at large. Finally, in some circumstances we apply the labels "developing country" and "developed country" in the same manner as the UN SDG report. However, we also recognize the ongoing debates around this terminology, and sometimes use other characterizations as appropriate, such as "less developed," "more developed," etc.

Limitations of our approach

Our methodological and analytical approach has shortcomings. These limitations do not invalidate the approach, but rather impose a challenge for future scholars and practitioners to account for the blind spots and counteract them over time. Limitations include:

Overreliance on information and communication technology (ICT) indicators. Conceptually, we understand access to information encompasses a variety of channels and outlets, both formal and informal, analog and digital, emergent and traditional (e.g., community radio and newspapers). In practice, our analysis is limited to data that are currently collected and publicly available, which is largely ICT-based. As such, measures of technical infrastructure, connectivity, and internet usage are prominent in our analysis. On one hand, the growth of the internet and digital networks have elevated the importance of access and introduced a crucial multiplier of scale – digital information is now available in real time, the world over. On the other hand, we acknowledge that measures focused on the internet do not and cannot tell the whole story.

Limited availability of indicators. Selected indicators cover a small fraction of the variables that could conceivably fall within each dimension of the DA2I framework. This is mostly due to the body of indicators available. Whereas measures of infrastructure and the social context of adoption tend to be more available, indicators of types and capabilities of use and the legal and policy environment are more rare and more likely to be limited in terms of geographic reach, public availability, comparability (i.e., being episodic or new endeavors without an established track record), and level of disaggregation. Some critical issues, such as language diversity on the internet, could not be addressed easily. Nor could international data on libraries, which had been collected periodically but not on an ongoing basis. There is currently data on computer usage, mobile and internet adoption, and ICT skills disaggregated by location, composition

Table 2: Indicators selected to establish the DA2I baseline, per dimension

DA2I Dimension	Indicators	Source(s)
Infrastructure	Population covered by at least a 3G mobile network, by type of network Active mobile broadband subscriptions per 100 inhabitants Fixed broadband subscriptions per 100 inhabitants Percentage of households with internet access Percentage of households with a computer	ITU
Social context of adoption	Percentage of population living below the national poverty line Gender Inequality Index Share of youth not in education, employment or training, by gender	World Bank UNDP International Labor Organization
Capabilities of use	Percentage of internet users Percentage of females using the internet Individuals using the internet, by age and gender Individuals with ICT skills, by type of skills by gender Individuals using the internet, by type of activity	ITU
Legal and policy environment	Civil Liberties Index Political Rights Index Freedom on the Net Freedom of Discussion	Freedom House Freedom House Freedom House Varieties of Democracy Index (V-Dem)

of households, education level, gender, and age, but the data are inconsistent and represent a very limited number of countries.

Exclusion of established indexes. At least a dozen relevant indexes were not selected for the DA2I indicator baseline due to the complexity involved with applying their combination of variables to the DA2I framework and analysis. Excluded indexes included the ICT Development Index (ITU), the Mobile Economy Index (GSMA), and the Inclusive Internet Index (the Economist). However, the DA2I baseline includes two indexes from Freedom House because they are critical to measuring the legal and political dimension of access to information.

Finally, it is of utmost importance to recognize that ours is one of many efforts to track the changing landscape of access to information. Many organizations collect and analyze data, prepare reports, maintain public databases, and build networks to make progress on a variety of connected issues. It's important to harmonize these efforts. Recognizing these interconnected values can magnify the impact on policymaking and support advancement of the SDGs through access to information. We want to recognize the organizations whose work is aligned with our own. (See the acknowledgements pages and the list of data sources.)

The chapter provides a baseline snapshot of the current state of development and access to information based on available data. It also describes opportunities to improve research efforts, data collection, and methodological choices as development agencies progress toward 2030. The chapter is divided into four sections, and each section corresponds to a dimension of the DA2I framework.

Section 1. Digital provides: technical infrastructure and connectivity

Section 2. Digital divides: internet users and capabilities for meaningful information use

Section 3: The social context of adoption: poverty, gender inequality, and youth opportunity

Section 4: The legal context of adoption: civil liberties, political rights, and freedom on the net

1. Digital provides: technical infrastructure and connectivity

The first dimension of access to information is physical infrastructure: the reach and robustness of information and communication technologies. Such infrastructure is critical to achieving a more equitable distribution of knowledge and resources, while also providing a platform for sustainable economic growth.

Our analysis uses two sets of indicators of technical infrastructure: mobile indicators and fixed, landline indicators. The distinction between these forms of access presents a contrasting picture of diffusion of technologies and corresponding constraints across settings. For example, telephone landlines and desktop computers were critical to the evolution of household internet access in more-developed contexts but have played smaller roles in less-developed contexts, due to the falling cost of wireless access and the explosive growth and availability of wireless handheld devices. Furthermore, each technical platform encourages certain types of use, discourages others, and launches homegrown appropriations. For example, much social networking is perfectly attuned to a handheld mobile device, while working with spreadsheets and complicated databases is much more inviting with a larger screen.

We use the following indicators to assess the infrastructure and connectivity in different regions of the world:

Mobile indicators

- Population covered by at least a 3G mobile network
- Active mobile broadband subscriptions per 100 inhabitants.

Landline indicators

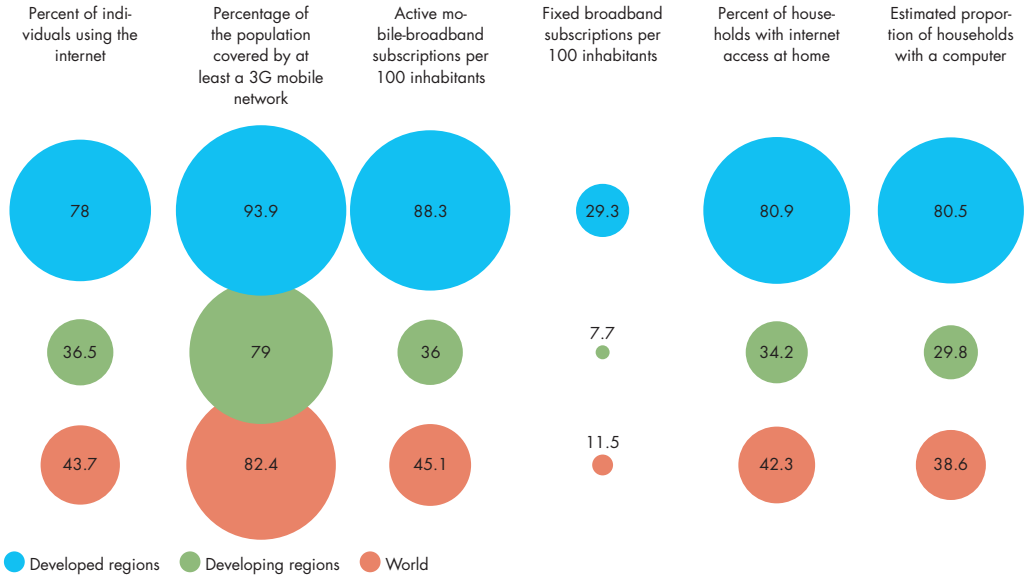
- Fixed broadband subscriptions per 100 inhabitants
- Percentage of households with internet access
- Percentage of households with a computer

Before diving into specific indicators, it's worth recognizing that globally people are increasingly using the internet to address their information needs. As shown in Figure 1.1, from 2010 to 2015 nearly 1.3 billion people came online, a majority via mobile devices. By 2016, almost 45 percent of the world's population used the internet and 80 percent of people lived in areas covered with a 3G network or better. Despite the network coverage, far fewer mobile broadband subscriptions were active in less-developed countries (36 per 100 inhabitants) than in more-developed countries (88 per 100 inhabitants). Internet access at home also grew from 14 percent to 34 percent in the same period.

1.1 Mobile indicators

Among the people of the world whom the UN SDGs are most intended to serve, mobile access is dominant. Mobile phones, and increasingly smartphones, have become the de facto information and communication tool in less-developed settings. Subsequent data demonstrate this.

Figure 1.1: Overall state of A2I infrastructure availability in 2015 worldwide



Source: ITU

Note: Data from 2015. Percentage of individuals using the internet (187 countries); fixed broadband subscriptions (196 countries); number of mobile subscriptions (189 countries); active mobile-broadband subscriptions (184 countries); percentage of population covered by at least 3G (166 countries); estimated proportion of households with a computer (185 countries); percentage of households with internet access at home (181 countries).

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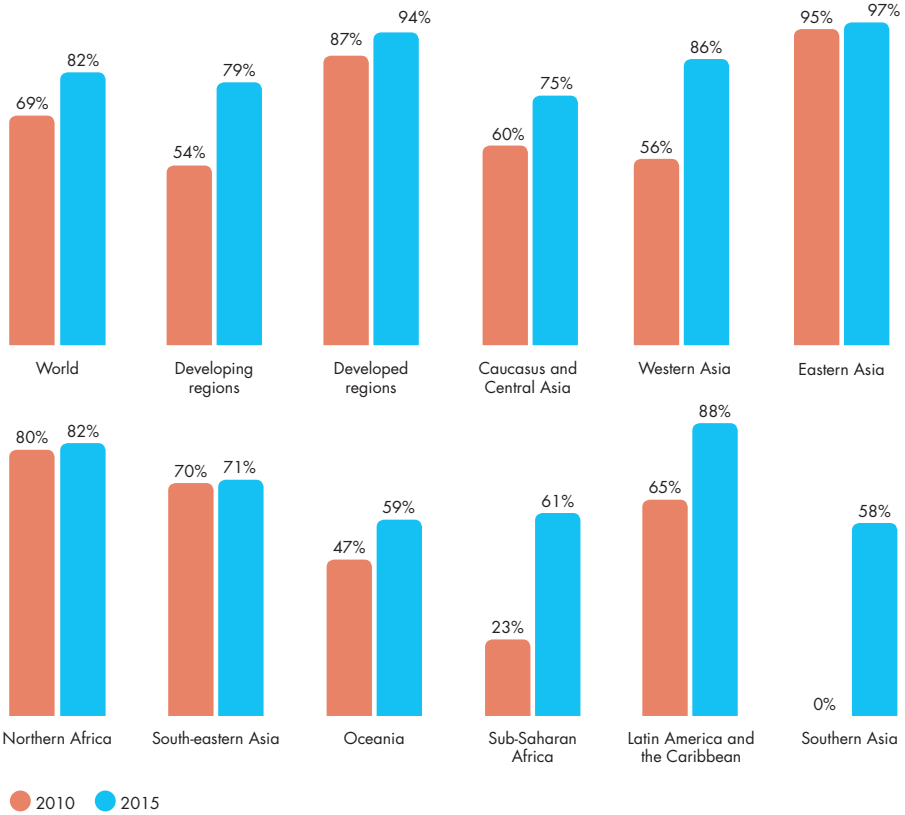
Figure 1.2: Five-year growth in percentage of population covered by at least a 3G network (2010-2015).



Source: ITU

Note: 166 countries in 2015, 84 in 2010.

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ITU Connect 2020 target: By 2020, at least 60 percent of individuals in less-developed countries and 20 percent in the least developed countries should be using the internet.

1.1.1 Population covered by at least a 3G mobile network

Third-generation wireless mobile telecommunication technology (3G) is a technical standard that enables new and advanced mobile applications, such as global positioning system (GPS), mobile video, video conferencing, etc. 3G is effectively a baseline networking technology for "smartphones" and internet-enabled mobile devices. At the end of 2015, 3.24 billion people (44 percent of the global population) were connected to the mobile internet. Of this connected population, 1.18 billion were accessing the internet using 2G networks and 2.06 billion were using 3G or 4G networks (GSMA, 2016).

As shown in Figure 1.2, in 2015 close to 80 percent of people living in less-developed countries were covered by at least a 3G mobile network – almost 30 percent more than in 2010. Southern Asia, with its dense population, exerted the biggest influence on the global statistic; the region's 3G coverage jumped from 0.4 percent to 57.9 percent of the population. Sub-Saharan Africa experienced the second largest jump – from 23.4 percent to 61.4 percent.

While the growth of 3G networks has been swift, large swaths of the population are still uncovered. Also, this statistic does not describe the percentage of the population that *uses* 3G networks. Rather, it describes the coverage that the towers provide – the percentage of people who *could* get on the network if they had the right phone, data plan, and social resources to meaningfully use the network.
Although there is no specific Connect 2020 target for 3G network coverage, this indicator can serve as a proxy to assess the likelihood that the infrastructure is available for more people to connect to the internet.

Based on this parameter, the countries with the lowest 3G network coverage are at the highest risk of not achieving the target of individuals using the internet. (See Figure 1.3.)

1.1.2 Active mobile broadband subscriptions per 100 inhabitants

While 3G coverage gets at potential connectivity, *mobile broadband subscriptions* start to get at the number of individuals actually using this infrastructure. This indicator measures the number of subscriptions to mobile broadband, and as such, it represents a more accurate depiction of the percentage of individuals who are able to connect to this service. Mobile broadband has a higher penetration rate than fixed broadband and is therefore an important channel for accessing information in developed regions. (In less-developed regions, mobile broadband subscriptions numbered 36 per 100 inhabitants, representing substantially more access than fixed broadband subscriptions, which numbered only 12 per 100 inhabitants.)

From 2010 to 2015, mobile broadband subscriptions increased from 12 per 100 inhabitants to 45 per 100 inhabitants worldwide. Growth was higher in more-developed countries, where subscriptions increased from 45 per 100 inhabitants to 88 per 100. Subscriptions in less-developed countries increased from 5 per 100 inhabitants to 36 per 100, with significant regional and cross country variations. (See Figure 1.4.)

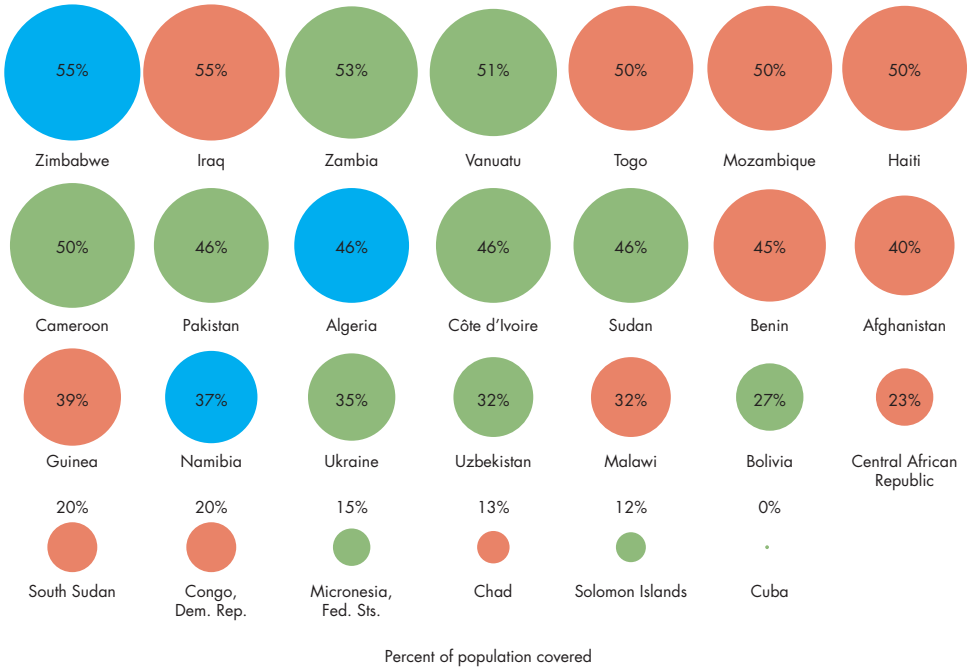
Latin America experienced the highest growth, increasing from 6.8 subscriptions per 100 inhabitants to 59.6 per 100. Eastern Asia experienced similar growth, from 6.9 subscriptions per 100 inhabitants to 57.7 per 100. Oceania and Southern Asia showed the

Box 1.1 : Rhizomatica empowers indigenous telecommunications operators in Mexico

Based on data from the Mexico Conectado program to promote digital inclusion in Mexico, in 2013 around 29 percent of urban households had access to internet in the country, while only 2 percent in rural areas could use these services. In order to address this regional gap, different organizations have promoted the consolidation of community networks to provide indigenous communities with access to connectivity. One example is Rhizomatica, an organization that has provided open-source telecommunication technologies to empower indigenous communities to become their own mobile operators and address the needs of the community. Additionally, Rhizomatica trains rural organizations to work with technology and works with rural organizations and government agencies to promote regulations that enable these groups to access services without requiring the support of bigger service providers.

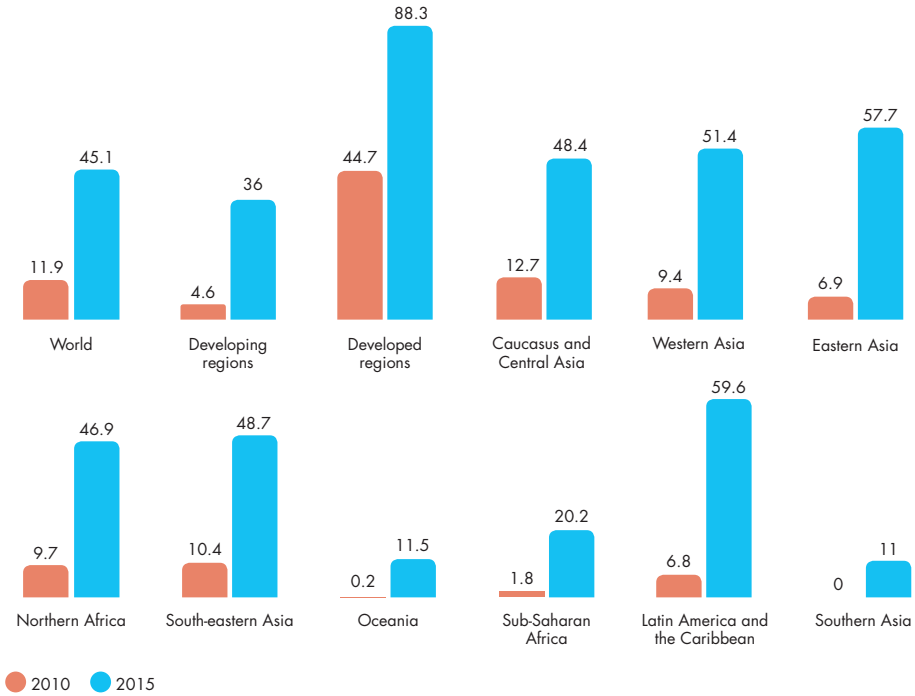
Sources: Mexico Conectado, Rhizomatica

Figure 1.3: Countries with the lowest 3G network coverage by income group (2015).



Source: ITU.
Note: 27 of 166 countries selected, data from 2015
Technology & Social Change Group, University of Washington

Figure 1.4: Mobile broadband subscriptions growth from 2010 to 2015 by region.



Source: ITU.
Note: Includes data from 198 countries in 2015, 184 in 2010
Technology & Social Change Group, University of Washington

Box 1.2: Kenya enables fast internet growth, but network speed and affordability are still a challenge

Internet services arrived in Kenya in 1995, when its first commercial ISP was established. By 2000, more service providers arrived in the country and cybercafés started flourishing, mostly in Nairobi. Later, the Communication Commission of Kenya was created to regulate the sector and provide licenses to broaden the market and limit the capacity of the incumbent monopoly. Over time, regulatory measures enabled additional parties to invest in upgrading infrastructure and offer services to make telecommunications more accessible. The country's efforts were supported by its participation on the Internet Governance Forum and the consolidation of a National ICT Masterplan in 2014 (renewed in 2017) to drive growth through access to connectivity services. Today, Kenya's rate of access to the internet is among the highest in Africa. Nevertheless, the speed of its network is still low in contrast with other countries, and most of the internet subscriptions there are for mobile services.

Source: Communication Authority of Kenya (2016); Souther & Kerretts-Makau (2012)

Box 1.3 Jordan's mobile subscriptions and ICT industry grow despite taxation controversies

According to Ericsson Mobility Report, June 2016, a young and growing population, rising GDP, and smartphone uptake are expected to continue encouraging mobile broadband subscription growth in the Middle East. In the case of Jordan, its ICT industry has gained significant relevance over the past few years, generating 12 percent of the country's GDP despite employing only 1 percent of the population. With its fast mobile market growth, Jordan now has four mobile operators competing next to some recently established mobile virtual network operators. At this point, 65 percent of Jordanians have smartphones, and relevant investment is taking place to increase 3G and 4G services. In this context, mobile broadband subscriptions are on the rise as well, also supported by infrastructure and market regulation to maintain high growth rates. However, Jordan continues to have one main barrier to access: a controversial special taxation on mobile services for users and providers.

Sources: Ericsson, Export.gov

slowest growth of mobile broadband subscriptions from 2010-15. Those regions also started the time period with the absolute lowest number of active subscriptions, 0.2 and 0.0 per 100, respectively, so the data probably reveal network effects – the value of the network grows in proportion to the number of people using the network. Sub-Saharan Africa increased its mobile broadband subscription base from 2 per 100 inhabitants to 20 per 100.

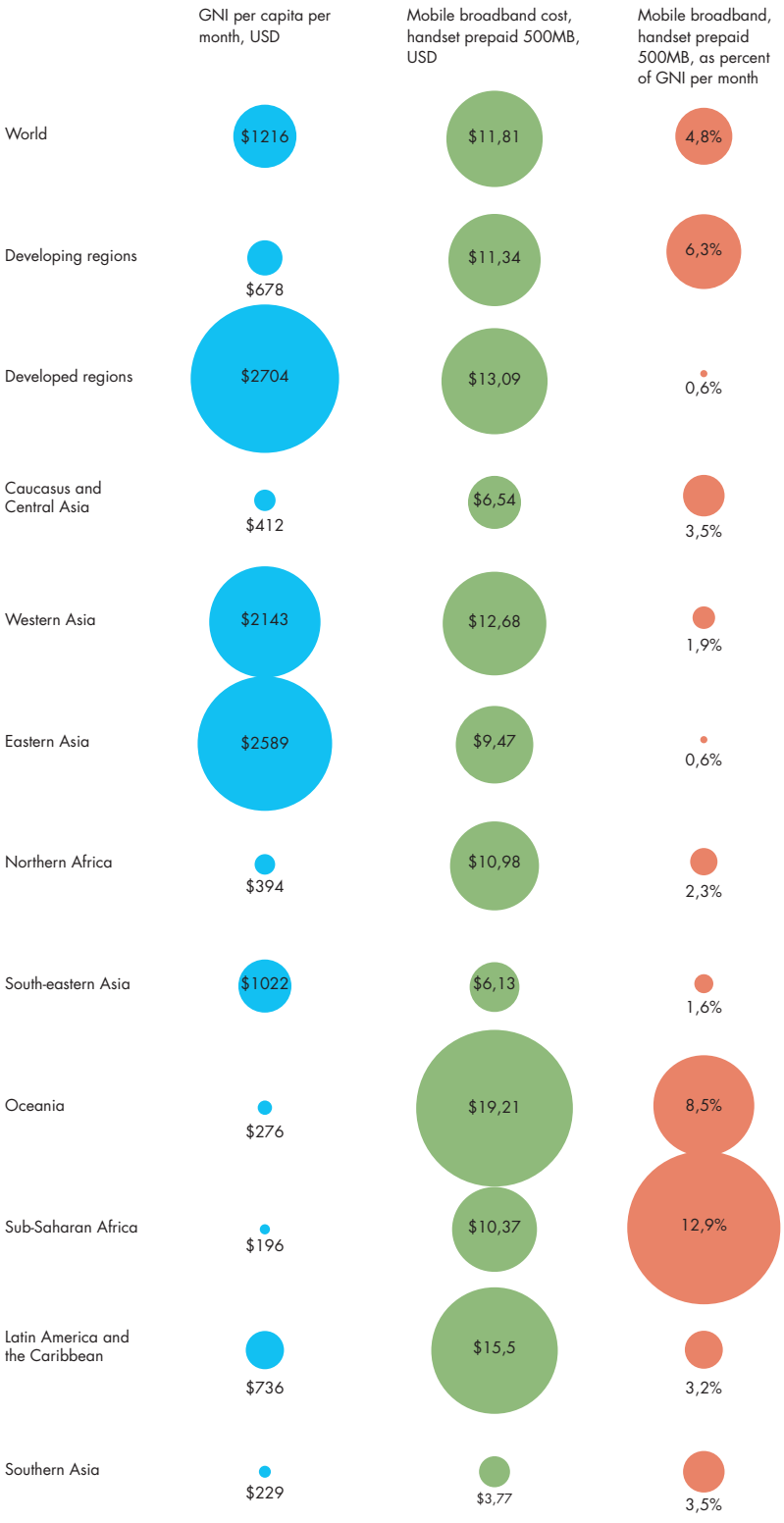
Affordability of mobile broadband subscriptions

Worldwide, mobile broadband adoption is accelerating and costs are dropping. According to the GSMA, 2016:11:

> *"There is an accelerating technology shift to mobile broadband networks across the world. Mobile broadband connections (3G and 4G technologies) accounted for almost 50 percent of total connections at the end of 2015, and are set to increase to more than 70 percent by 2020. The factors driving this migration are greater availability and affordability of smartphones, more extensive and deeper network coverage, and in some cases operator handset subsidies."*

While costs may be dropping, "affordability" means something different in each context, and the cost of services and devices remains a challenge for internet access. According to the ITU (2016), monthly average worldwide mobile broadband prices have dropped to 5 percent of gross national income (GNI), in line with the Connect 2020 target, but when that target ratio is viewed by region it reveals uneven gains. As our analysis reveals, across less-developed regions mobile broadband costs on average 6.8 percent of monthly GNI per capita. The situation is worse in Sub-Saharan Africa, where mobile broadband costs almost 13 percent of monthly GNI per capita, and in Oceania at 8.5 percent. Contrast this with more-developed regions, where mobile broadband costs just 0.6 percent of monthly GNI per capita. (See Figure 1.5: Mobile broadband costs as a percentage of monthly GNI.) Multiple factors influence broadband prices and the way mobile service is rolled out in different regions. Governments play a leading role by setting factors

Figure 1.5: Mobile broadband costs as a percentage of monthly GNI.



Source: ITU.
Note: 177 countries, data from 2015.
Technology & Social Change Group, University of Washington

Box 1.4: Mobile broadband efforts to make prices more affordable: Private industry strives to attract lower-income customers in Latin America

In Latin America, one of the main reasons why access to mobile broadband has increased over the past few years is the decreasing price of services, motivated by regulatory measures that boost competition between private providers. Within this context, market stakeholders have generated plans that adapt both to the needs of population with high purchasing power and to those located in "the base of the pyramid," a concept that is popularly utilized to describe individuals from the lower three-tenths of the income range. In countries with high levels of inequality such as Mexico, Brazil, or Argentina, this target group conforms from 20 percent to 35 percent of the population, thus representing an opportunity for organizations that can provide services at low operational costs.

Source: GSMA, 2013

such as tax policy, regulatory schemes, spectrum management, and terms of competition. Private firms can also offer creative pricing and flexible service packages to reach both wider and more narrowly targeted customer groups. When monopolistic behavior can be avoided, the growth in subscriptions can drive variation and lower prices. These forces can be mutually reinforcing – more users lead to more variation in pricing and offerings and vice versa (Alliance for Affordable Internet, 2016). It will be interesting to track this growth over time. Mexico, Argentina, and Brazil provide a useful case study for this dynamic. (See Box 1.4: Private industry strives to attract lower-income customers in Latin America.)

Mobile connectivity and use is an essential access channel for information worldwide, and especially in less-developed communities. These indicators represent the starting point for understanding access of this type. As people continue to use and appropriate these tools to serve their information needs, researchers should be vigilant for new indicators to provide a deeper understanding of how mobiles contribute to development.

1.2 Landline indicators

If global internet diffusion followed the path of more-developed communities, it would begin with computer access, then those computers would be networked together, then those networks would grow faster and become more robust. Due to a variety of social and market forces, diffusion has not followed that path. Still, those indicators are useful because they describe certain dimensions of access that are relevant for the UN SDGs.

1.2.1 Percentage of households with a computer

A personal computer in the home describes a certain social environment, with a minimum of security, electricity, space, resources to pay for the outlay and maintenance, etc. And even in settings where those material resources are present, there may be other social and personal factors that make a household computer undesirable or unrealistic. Still, in many settings people aspire to a home computer and perceive its utility.

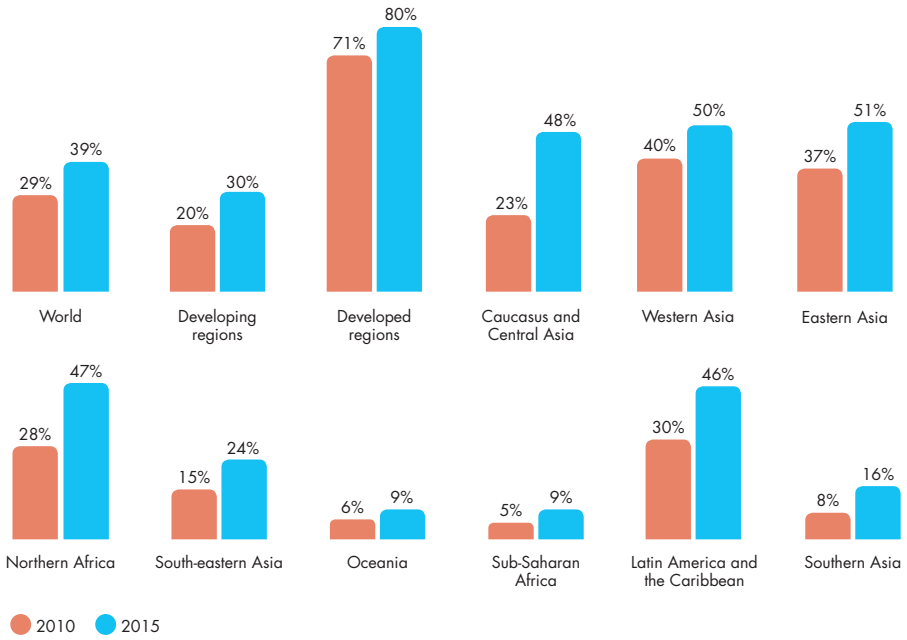
Over the period from 2010 to 2015, household computer penetration grew from 29 percent to almost 40 percent. This growth was experienced in both less-developed and more-developed countries, however with significantly different levels of penetration – almost a third of households in less-developed regions had a computer available compared to 80 percent in more-developed ones. The highest growth was in the Caucasus and Central Asia, followed by Northern Africa (25 and 19 percentage points, respectively, over 5 years). (See Figure 1.6: Estimated proportion of households with a computer.)

1.2.2 Percentage of households with internet access

The household computer is substantially more valuable when it can take advantage of the network effects of the internet. While mobile internet access is the dominant form of connectivity around the world, the percentage of households with access at home has grown. From 2010 to 2015, home internet connectivity increased from 24 percent to 42.3 percent worldwide, which is on track to achieve the ITU Connect 2020 target of 50 percent household access, particularly in less-developed countries. For the least developed nations, the target is set at 15 percent.

Despite this progress, regional variation once again reveals significant gaps. Western Asia (57 percent) and Eastern Asia (56 percent) achieved the highest growth. At the other end of the spectrum, fewer than 10 percent of households in Sub-Saharan Africa and Oceania are connected to the Internet. Jordan, Morocco, Kazakhstan, Armenia, Thailand, and Costa Rica are among the countries that experienced the highest growth (relative to where they were in 2010). (See Figure 1.7 for household internet penetration from 2010 to 2015.)

Figure 1.6: Estimated proportion of households with a computer.

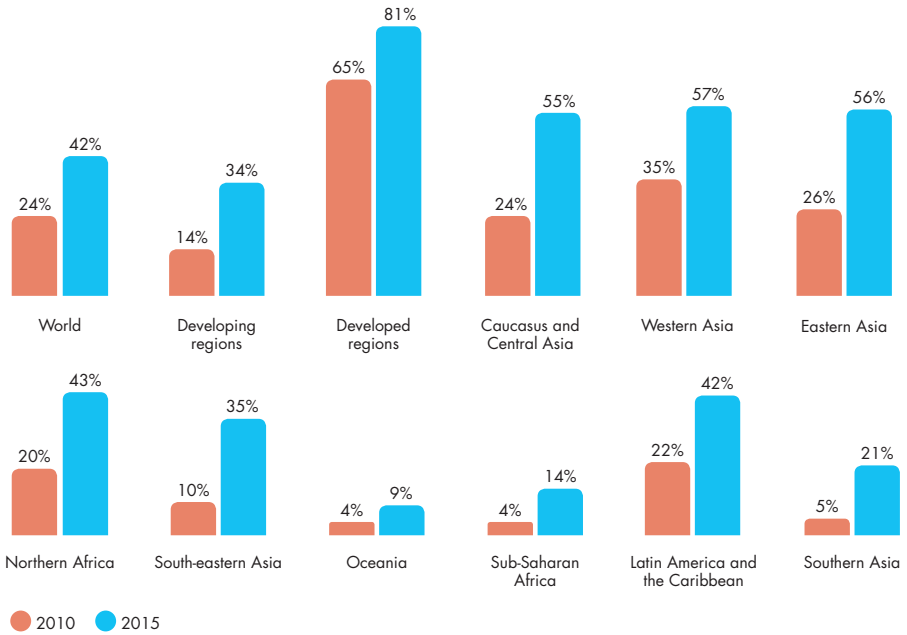


Source: ITU.

Note: 182 countries in 2015, 85 in 2010.

Technology & Social Change Group, University of Washington

Figure 1.7: Household internet penetration growth from 2010 to 2015.



Source: ITU.

Note: 181 countries in 2015, 179 in 2010.

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Affordability of household internet access

Affordability is the key bottleneck for household internet access. "Available data from 2013 confirm that the costs of ICT equipment and services remain an important barrier in countries that track this information. In Mexico, Brazil and Colombia, populations covered by the survey indicate that either equipment costs or service costs are the most important reason for not having internet access at home" (ITU, Measuring the Info Society Report 2016).

1.2.3 Fixed broadband subscriptions per 100 inhabitants

Broadband subscribers is an indicator of the prevalence of faster, higher-capacity connections. These connections tend to be more reliable and particularly useful for digital activities that rely on intense use of resources – multimedia, data-intensive two-way communication, etc. Broadband subscriptions are often shared connections at businesses, households, apartments, libraries, or community centers. Although mobile internet connectivity is the most popular access vehicle in all regions of the world, fixed broadband is also growing, albeit at a slower pace. It also offers unique benefits: higher speeds and greater reliability (ITU, Measuring the Info Society Report 2016).

Worldwide, from 2010 to 2015, fixed broadband grew from 8 to 12 subscriptions per 100 people. Growth was slower in less-developed regions, which increased from 4.2 to 7.7 subscriptions per 100 people, than more-developed regions, which increased from 23.9 to 29.3 per 100. Sub-Saharan Africa (0.2 per 100 people) and Oceania (0.2 per 100) experienced the least growth. Eastern Asia led with 10.2 additional subscriptions per 100 inhabitants. (See Figure 1.8 for regional growth of fixed broadband.)

Affordability of fixed broadband

The primary impediment to growth of fixed broadband is cost. Worldwide fixed-broadband affordability grew until 2013; since then, affordability gains (as a percentage of per capita GNI) have stagnated. According to the ITU: "These developments, which distinguish fixed-broadband services from all other services for which ITU collects data, are alarming, since higher fixed-broadband prices will remain a major barrier to further uptake" (ITU, *Measuring the Information Society Report 2016:3*).

This situation is pronounced in less-developed countries. From the ITU: "In developing countries, fixed-broadband prices remain relatively high, and actually became less affordable during last year. In 2014, the ITU basket in developing countries represented an average of 29 percent of GNI p.c., up from 25 percent a year earlier. Globally, the fixed-broadband basket as a percentage of GNI p.c. grew from 17.9 to 20.8 percent. This average conceals huge differences between individual countries but shows that, in many developing countries, the service remains out of reach for many people, especially those with low incomes." (See Figure 1.9: Fixed-broadband prices as percentage of GNI.)

This section has assessed regional differences in the availability of information and communications infrastructure using five baseline indicators. Landline and mobile connections have followed different trajectories over the past five years, with substantial increases in availability of mobile connections relative to landline connections, driven by differences in affordability. In order to have digital access to information, technical connectivity must be present. Then, a variety of social factors converge, which further enable and constrain the quality and nature of that access. Connectivity provides many benefits, but that picture is incomplete without filling in the critical gaps in access – the divides between and within the haves and have nots that are artifacts of our social relations and the social context in which users access the internet.

2. Digital divides: internet users and capabilities for meaningful information use

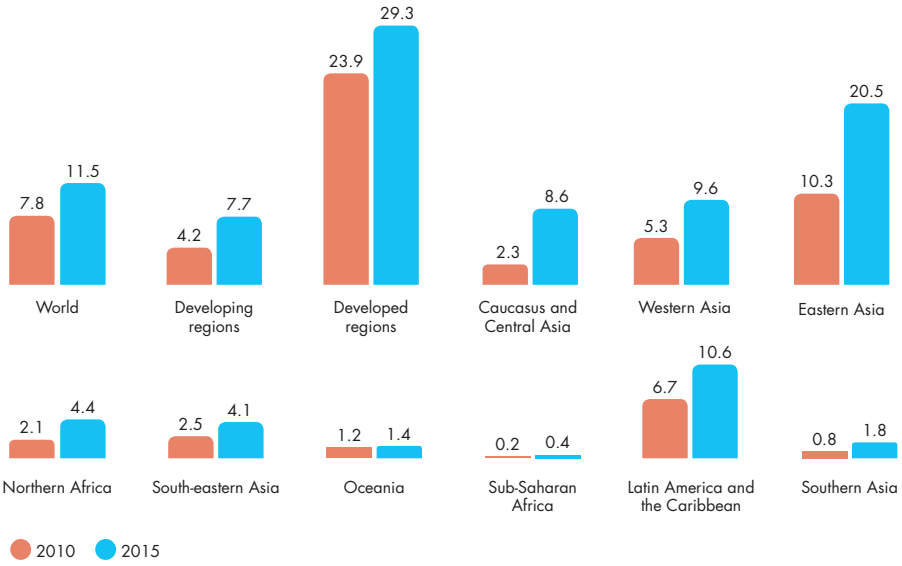
While physical connectivity constitutes a critical building block in the information access ecosystem, it is insufficient to guarantee meaningful access. The physical infrastructure is laid across a social landscape that is fraught with barriers and inequities that afford some people the resources to make use of connectivity while hindering meaningful access by others. Socio-demographic analysis helps reveal resources and barriers that affect the quality of information access.

This section analyzes the socio-demographics of the people who access, use, create, and share information via ICT, per the capabilities outlined in the DA2I framework. We also consider the other side of the equation: those on the other side of the digital divide, for whom access is insufficient.

In order to gauge the impact of the UN SDGs through the lens of DA2I, we use the following indicators:

- Percentage of population using the internet
- Percentage of females using the internet
- Individuals using the internet, by age and gender (limited data available)
- Individuals with ICT skills, by type of skills by gender (limited data available)
- Individuals using the internet, by type of activity (limited data available)

Figure 1.8: Fixed broadband growth by region 2010 - 2015.

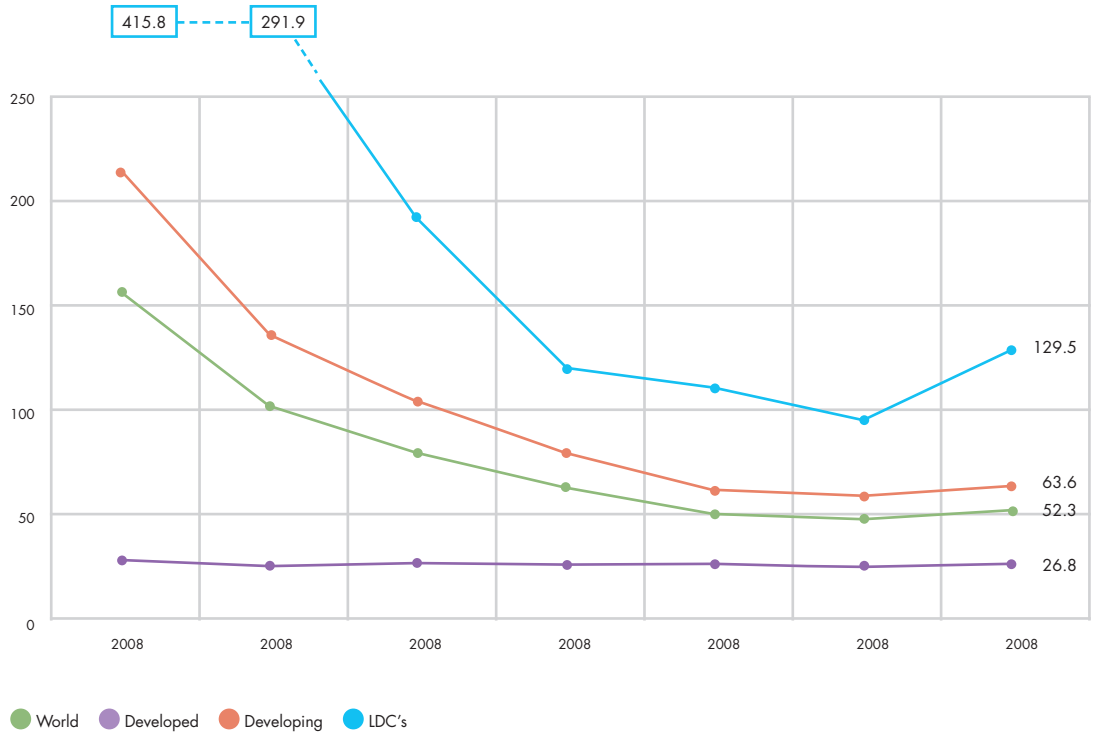


Source: ITU.

Note: 197 countries for both years.

Technology & Social Change Group, University of Washington

Figure 1.9: Fixed-broadband prices as percentage of GNI 2015



Source: ITU, Measuring the Information Society Report (2016)

2.1 A social demographic map of internet users in 2015

2.1.1 Percentage of population using the internet

Internet access is widely recognized as a key tool of development – for jobs, for information, for connection to people who are not near, and myriad other reasons. The lure is so powerful that the ITU's Connect 2020 agenda enshrined it in a target:

> ***Connect 2020 target: 50 percent of individuals should be using the internet in less-developed countries and 20 percent in the least developed countries.***

That target has been largely met, but once socio-demographics are taken into account, the gains are revealed to be less consistent. As our analysis of ITU data shows, by the end of 2015, almost half of the world's population was online (up from 30 percent in 2010) – more than 3 billion people. All regions experienced some growth; however, in Southern Asia, Sub-Saharan Africa, and Southeast Asia, more than 70 percent of the population still remains offline. In Oceania, that number rises to 87 percent offline – the highest percentage among all the regions.

Caucasus/Central Asia (up 27 percentage points) and Latin America (up 19 points) experienced the greatest growth. The population of internet users in Kazakhstan, Armenia, and Belarus increased from 25 percent to more than 50 percent in that time period. In Latin America, Uruguay, Costa Rica, and Ecuador experienced similar growth; it is reasonable to infer that by the growth in mobile broadband access in Latin America, as discussed in the previous section. (See Figures 1.10 and 1.11: Growth in percentage of individuals using the internet by region 2010- 2015.)

Despite the growth in internet users worldwide between 2010 and 2015, many countries are at risk of failing to achieve the Connect 2020 target. Most of these are low-income countries; however, eight of the countries at the highest risk of missing the target are low-middle income (Bangladesh, Timor-Leste, Kiribati, Djibouti, Solomon Islands, Papua New Guinea) and upper-middle income (Turkmenistan, Angola). (See Figure 1.12 below.)

2.1.2 Percentage of females using the internet

Gender is a key indicator to monitor due to the essential role that women play in development. As Nancy Hafkin succinctly states in this report: "The benefits to girls and women of increased access to information are myriad and far-reaching on both individual and collective levels and in many realms – social, economic, and political." The correlation between gender equality and development means that promoting information access for women is central to UN SDG [5], and to development generally. That is also why ITU's Connect 2020 enshrined it as a target:

> ***Connect 2020 target: Gender equality among internet users should be reached***

However, according to ITU estimates, the internet user gender gap increased from 11 percent in 2013 to 12 percent in 2016 (ITU, 2016). The region of Africa exhibited the widest gap in 2016 (23 percent) followed by Arab States (20 percent), with the smallest gap in the Americas (2 percent). In terms of actual values, the percentage of women internet users in less-developed regions (37 percent) was much lower than in more-developed regions (80 percent), which reflects general trends in internet penetration.

On a country-by-country basis using available ITU data (84 countries surveyed between 2011 and 2015), Turkey, Saudi Arabia, Palestine, Sudan, Morocco, Montenegro, and Croatia exhibit the largest internet use gender gap. (See Figure 1.12.1 for the list of countries with the widest gender gap in 2015.) At the other end of the spectrum, Finland, Ireland, Australia, the United States, Panama, and Jamaica are the first six countries where a higher proportion of women are using the internet than men (proportional to the total population of women).

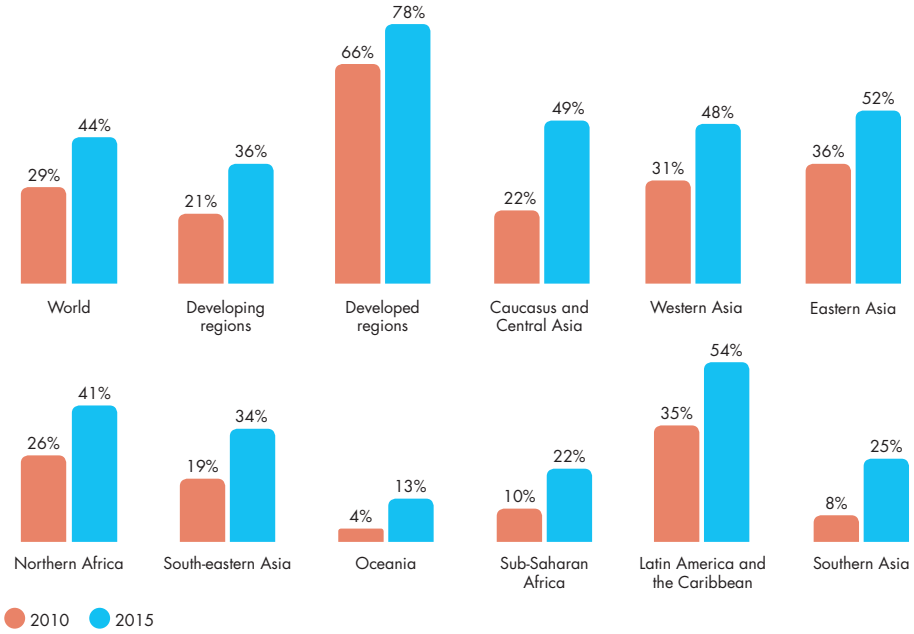
Gender disparity is a statistic that requires careful contextual examination. For example, in cases where internet use is not widespread, gender disparities may be small. This is the case in the next section of the report on capabilities; the limited data available show the skills disparity between men and women is small, but that could be explained by factors such as the education levels and household incomes of early adopters. These effects may be more pronounced than gender at first, but as digital access diffuses into the wider population, gender effects become more visible. The intersectionality of gender means that this dynamic interacts with other social forces and requires careful parsing.

2.1.3 Individuals using the internet, by age (limited data available)

We know that age influences access to resources across the board, including information. Across all 76 countries where data are available, among 15- to 24-year-olds, more than 70 percent of both women and men use the internet. In El Salvador and Indonesia, however, only 50 percent of people in that age range are online. The lowest rates of access for young people are found in Cambodia and Bangladesh, where fewer than 25 percent of those ages 15-24 use the internet.

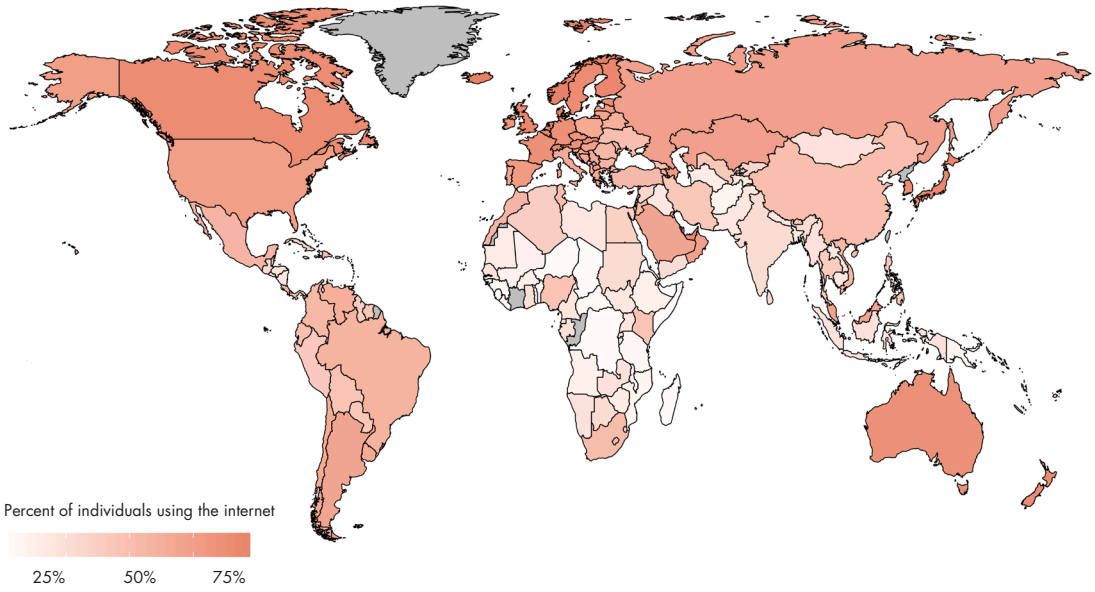
Understanding who is using the internet, especially in various economic contexts, is valuable for understanding the potential impact of information access.

Figure 1.10: Change in percentage of Individuals using the Internet by region (2010-2015)



Source: ITU.
Note: 188 countries.
Technology & Social Change Group, University of Washington

Figure 1.11: Percentage of the population using the internet (2015)



Source: ITU.
Note: 188 countries
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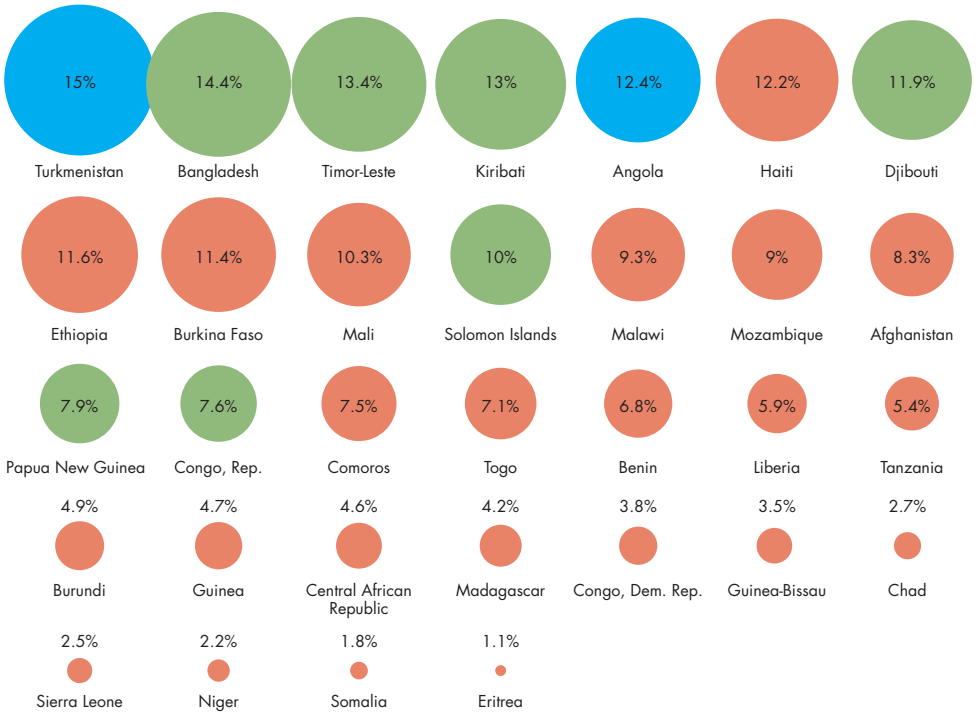
Figure 1.12: Countries at the highest risk of not achieving the Connect 2020 target



Source: ITU.
Note: 32 countries shown, data from 2015
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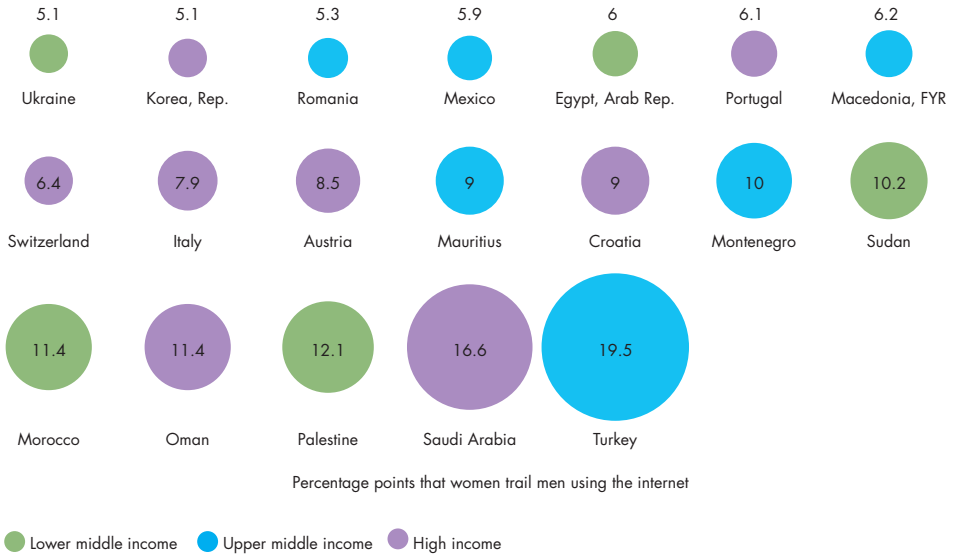
Figure 1.12.1: Countries with the widest internet access gender gaps, measured by the percentage of men using the internet minus the percentage of women using the internet (2015)



Source: ITU.
Note: 19 countries shown, data from 2013-2015, depending on country.
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Box 1.5: Digital literacy programs boost women's and girls' access to internet worldwide

Addressing the phenomenon of gender digital divide is a complex task, given that many factors beyond the price and supply must be considered. For instance, some of the main barriers that prevent women from accessing technology are cultural demands, lack of access to education, and missing digital literacy resources. As a response, the International Telecommunication Union has been promoting the Girls in ICT Day during the past few years, connecting hundreds of organizations worldwide to support women and girls accessing technology services, mainly including the internet. Additionally, governments have started to consolidate public-private collaboration with different organizations, driving initiatives that empower women through technology. Some examples are Intel's "She Will Connect" program in Kenya, Nigeria, and South Africa; Mexico's "Código X;" and India's "Internet Saathi."

Sources: One, Internet Saathi, Girls in ICT

The technological delivery systems that transport information are not neutral – they re-create and sometimes exacerbate the social dynamics of the communities they inhabit. As such, programs to leverage information access for development need to actively account for the opportunities and challenges that socio-demographics reveal in order to maximize impact.

2.2 Capabilities: The personal capacity to use information meaningfully in everyday life

Capabilities refers to an individual's ability to learn to use information and communication tools and resources, and to apply information in meaningful ways. It is an essential component of information access, and as such comprises one dimension of the DA2I framework. Capabilities are also highly dependent on the setting. The challenges and resources of individual communities (social, economic, demographic, cultural, etc.) influence the opportunities, demands, and norms that shape who possesses which skills and how capabilities are developed. Due to the limitations of data collected on capabilities globally, we focus here on ICT skills.

However, measurement of information and communication technology skills is complicated. First, there is no universal agreement on a definition of ICT skills. There are numerous definitions in use, and most of them undergo regular review and revision to keep pace with changes in technology and digital work opportunities. At one time, productivity applications may have been a reasonable approximation of work-related ICT skills; however, that definition is too limited. Today, ICT skills connote a spectrum of skills.

In other contexts, we have written about categories of skills: computer, media and information, digital, web, coding, data, mobile, and life skills (Fellows et al., forthcoming; Clark et al., 2016; Garrido & Sey, 2016; Garrido et al., 2012). All of these skills are typically united by the concept of literacies (digital literacy, information literacy, data literacy, etc.). However, even these definitions of literacies are fluid, changing over time, and overlap. For instance, mobile information literacy is composed of an emerging set of skills that incorporates elements of digital literacy, information literacy, and web literacy as they are experienced on a mobile platform. (See Box 1.6.)

The only area of agreement is that they all include skills that are relevant for work, thus making it an even more challenging task to specify which ICT skills are important for "employment, decent jobs and entrepreneurship." While capabilities are intrinsic to successful access, they are also directly named within the UN Sustainable Development Goals framework. Specifically, Target 4.4 recognizes that underlying access to information skills are central to employability and economic participation:

> *"By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship."*

Limited data further complicates our ability to gauge the capabilities of different groups across countries and regions from the perspective of access to information. The European Union is the only region that has consistently collected data on ICT skills and types of use since 2007. Between 2014 and 2015, a handful of countries followed suit, harmonizing their data methods and collection following the EU questionnaire on ICT for Households and Individuals.[2] Currently, the ITU indicators for ICT skills and use include data from 51 countries (38 from more-developed and 13 from less-developed nations).

The DA2I baseline will track progress on two indicators to gauge capabilities (albeit in a limited number of countries):

Box 1.6 Digital and information literacies for the mobile-first generation

For billions of people coming online around the world, mobile phones (and increasingly smartphones) are their point of entry to the internet. This is true in both more-developed and less-developed countries. However, the user experience on a smartphone is very different from that on a PC or a feature phone. In order to take advantage of the benefits that information and communication technologies offer, one must have the skills and knowledge to do so. TASCHA's Mobile Information Literacy – a combination of digital, internet, and information literacies for smartphone-first and smartphone-centric populations – fills a critical gap between access alone and realization of the benefits mobile technologies and applications can have. TASCHA developed Mobile Information Literacy (MIL) curricula and trainings for various geographies and audiences, taking into account local contexts and conditions. Mobile-specific information literacy is important for the reasons outlined above: (1) the explosion of mobile-first and mobile-centric users; (2) information behavior differences on a mobile phone versus a PC; (3) most digital and information literacy trainings are currently oriented to PC users; and (4) research shows that the lack of digital skills is a significant barrier to effective access, use, and uptake.

Source: Clark et al. (2017), Technology & Social Change Group, University of Washington

- Individuals with ICT skills, by type of skills by gender
- Individuals using the internet, by type of activity (using type of activity as proxy of skills)

2.2.1 ICT skills, by type of skills and gender

What types of ICT skills do people possess?
The top four ICT skills for people living in less-developed countries are:

- Copying/moving a folder, 37 percent
- Sending emails, 35 percent
- Pasting within a document, 30 percent
- Transferring files, 23 percent

The lowest rates of proficiency reported in less-developed countries are mostly related to productivity applications, such as spreadsheets (18 percent) and presentations (17 percent). It's difficult to judge whether this means that skill levels are generally low, or whether the data are merely measuring a skill that no one wants or uses. A mechanic who can't rebuild the engine of a rare car she never sees and no one drives would not be thought of as "low skilled." It's worth monitoring changes to these data over time, but it would be premature to conclude that low proficiency with productivity apps means a person is not using ICT and developing skills that are relevant for their life. Better indicators might include tasks such as sending SMS messages, accessing a VPN, transferring data between phones, or appropriating phone networks for financial purposes such as banking. Programming proficiency is low across country income levels.

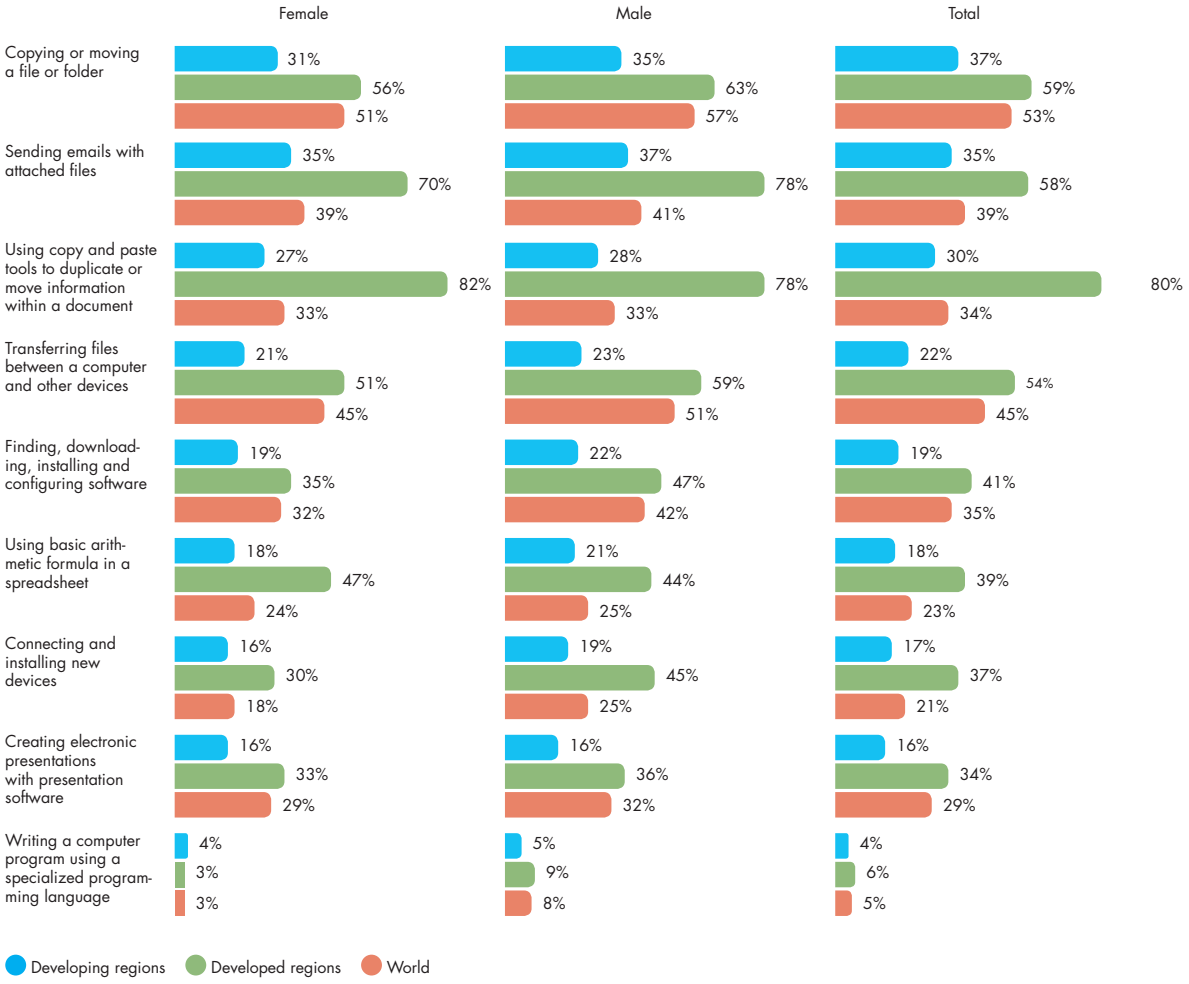
Do these data change when analyzed based on gender?
Among people from the countries sampled, only small differences in skill levels between men and women emerged in both less-developed and more-developed countries. The biggest difference is across groups, not gender. (See Figure 1.13: ICT skills by type of skill by gender.) There is generally a smaller gender gap among those sampled in less-developed countries, where women's skills in technical aspects of computer use are closer to those of men. This effect could also be explained by differences in the instruments for data collection and differences in research questions and design.

2.2.2 Individuals using the internet by type of activity.

The ways people use the internet provide insight into their purposes and skill levels. They also advance our ability to understand the ways these resources can be leveraged to achieve social goals. How people use the internet is indicative of what they want to accomplish and what information and communication tools they prefer or are able to use.

However, standardized measurement is once again thwarted by local settings, conditions, and data. Information influences development in such different ways that the activities measured in "individuals using the internet by type of activity" only begin to tell the story of how information access can advance development. Often, available data serve a particular purpose in a particular setting. For example, asking about "internet banking" may not capture the way funds are transferred via mobile phones in rural settings.

Figure 1.13: ICT skills by type of skill by gender (2015)



Source: ITU.

Note: 52 countries. Regional averages not representative of the world, but illustrate that large skill gaps exist.

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People in less-developed countries use the internet for online courses more actively than people in more-developed countries. Twenty percent of people in less-developed countries reported taking an online course compared to only 7 percent in more-developed ones.

Even as we recognize the limitations of these baseline numbers, the process of naming them and beginning to flesh out the dimensions of how people use information resources such as the internet is an important step.

- People in less-developed countries are using social networking sites more actively than people in more-developed ones (71 percent compared to 67 percent).
- Sending emails seems to be more prevalent among countries in more-developed regions (81 percent compared to 53 percent).
- Only 39 percent of people in less-developed countries use the internet to access blogs, forums, or discussion sites and to read or download news or books, compared with 75 percent in more-developed countries. The reason for this gap is unclear, but it could be a product of limited resources in certain languages, along with distrust of the media. It's also possible that users who don't participate in forums or seek out news online may focus those activities on social networking sites.
- Twenty-seven percent of those in less-developed countries look for health information online. Interestingly, this is very close to matching the 30 percent of people who do so in more-developed countries.

- Only 24 percent of people in less-developed countries use the internet to get information from government organizations, compared to 56 percent in more-developed ones. Similarly, only 14 percent use the internet to interact with government, compared to 57 percent. (See Figure 1.14.)

Our discussion of capabilities is derived from available data, which primarily comes from studies conducted in community computer labs and similar settings in Europe. Over time, it will be useful to analyze different sets of capabilities and how those capabilities relate to different technologies, development goals, and future research priorities. This calls for more robust data collection to enable more nuanced analysis in the future.

3. The social context of adoption: poverty, gender inequality, and youth opportunity

As detailed in previous sections of this chapter, physical infrastructure and technical connectivity provide the first steps to information access. Understanding the demographic makeup of internet users – such as location, gender, and age – provides a more nuanced lens, showing that access alone is not enough to overcome the barriers and inequities that hinder access by many. Further still, ICT skills (or lack thereof) represent yet another defining characteristic of access to and use of information and technology. Social context is the next essential ingredient to understand how access to information can materialize into meaningful use.

Studying the social context that enables meaningful use of information also reveals the intersectional nature of information use – where the personal dimensions of identity overlap, reinforce, and multiply the resources and barriers of people and communities. Accounting for the privilege and power dimensions of information access (poverty, race, gender, age, caste, etc.) helps tease out constraints (and opportunities) that directly affect the quality of access, equity/justice imperatives, and the ultimate success of interventions.

This section presents critical social context considerations that shape the conditions in which physical infrastructure, demographics, and capabilities exist.

We use the following indicators to examine the social context of use across different regions:

1. Percentage of population living below national poverty line

2. Gender Inequality Index

3. Share of youth not in education, employment or training by gender

3.1 Poverty through the lens of access to information

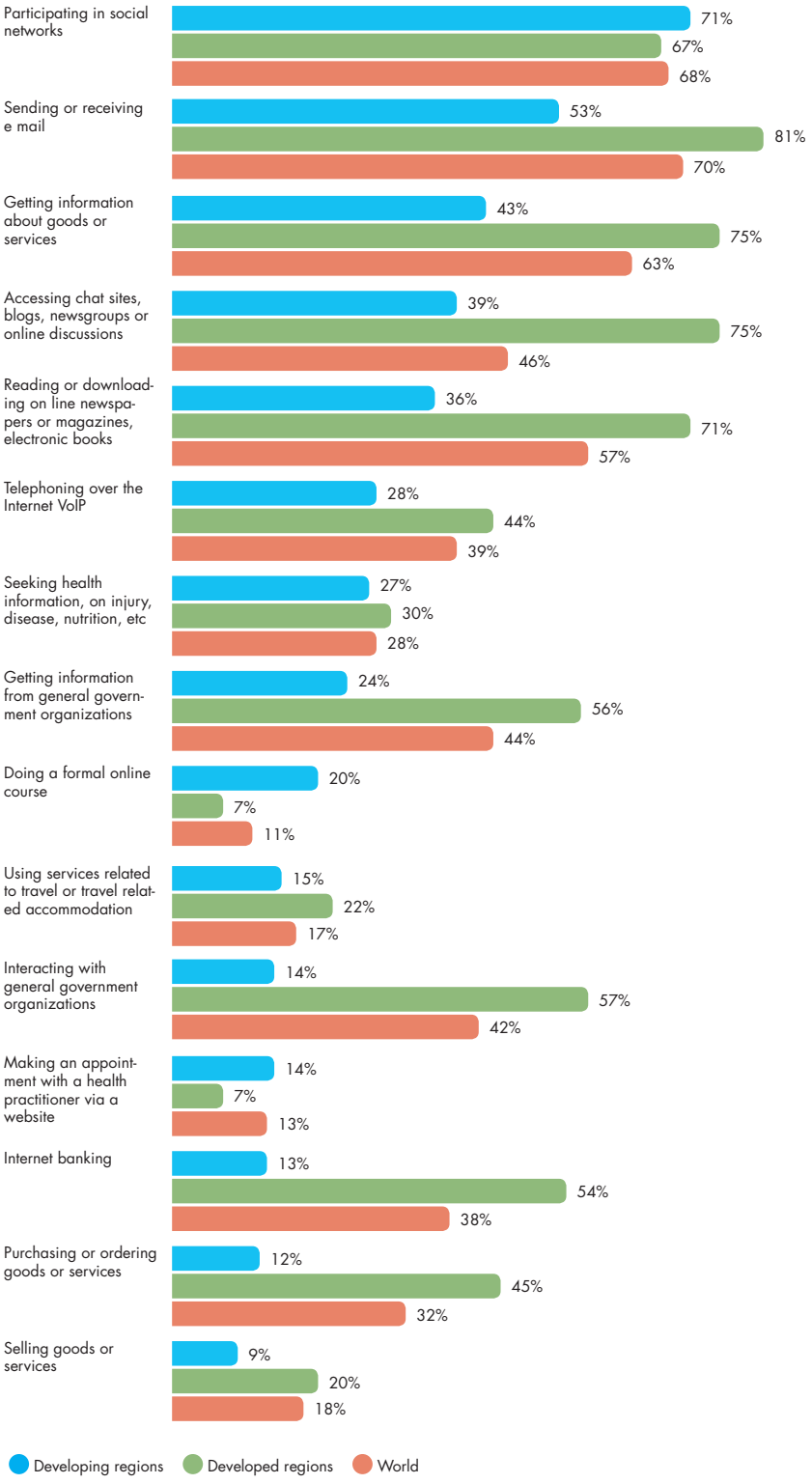
Poverty affects all aspects of life. Poverty and inequality are among the main drivers constraining people's agency to live the lives they choose to live (Sen, 2001). From 2002-2012, the share of people in abject poverty (living below the international poverty line) dropped from 26 percent to 13 percent (SDGs 2016 Report). If economic growth rates of the past decade continue for the next 15 years and this growth benefits everybody equally, poverty could fall to 4 percent of the population (ibid). Despite this optimistic forecast, poverty still affects the lives of almost 1 billion people around the world today. Regional poverty rates provide a clearer picture of persistent poverty that is masked by international estimates. By 2015, close to a third of people around the world lived below national poverty lines – 45 percent in Sub-Saharan Africa, 37 percent in Oceania, and 27 percent in Latin America. (See Figure 1.15 for national poverty rates by region.)

While more revealing than international estimates, regional rates still mask significant variations by country. For example, in Mexico, one of the richest countries in Latin America in terms of GDP, 53 percent of the population lives below the national poverty line. This percentage is almost double the regional average of 28 percent. In Sub-Saharan Africa, poverty rates range from a high of 76 percent in Equatorial New Guinea to a low of 19 percent in Botswana.

It would be simplistic to assume that merely expanding internet access will mitigate the structural dimensions of poverty. While improvements in infrastructure and connectivity expand resources and opportunities to a wider segments of the population, the gains that access provides are bounded by larger societal forces. For example, internet access may mean that a resident of Mexico City might be able to produce a great resume and learn from YouTube videos how to impress an interviewer, but there still may not be that many jobs available. While we don't want to denigrate many of the personal victories that access enables, we also want to acknowledge the nuance of the storyline – access is important, but transformational effects require systemic changes. Access is just one piece.

Even though this holds for the poorest countries in the world, it not as clear when we look at countries in the lower-middle-income and upper-middle-income levels. (See Figure 1.16.) Countries such as South Africa, Brazil, Colombia, Turkey, Costa Rica, Mexico, and Romania, which in general exhibit higher income per capita, have less than 60 percent of their population online. This indicates that access to the internet is not enough, in itself, to improve the lives of people. There is no question that the highest need at all levels is in the poorest countries. However, the variance in the economic position of several upper-middle and lower-middle-income countries begs the question of what is the true impact of access to information on the reduction

Figure 1.14: ICT activities by type of activity



Source: ITU.

Note: 61 countries. Regional averages not representative of the world, but illustrate that large gaps exist.

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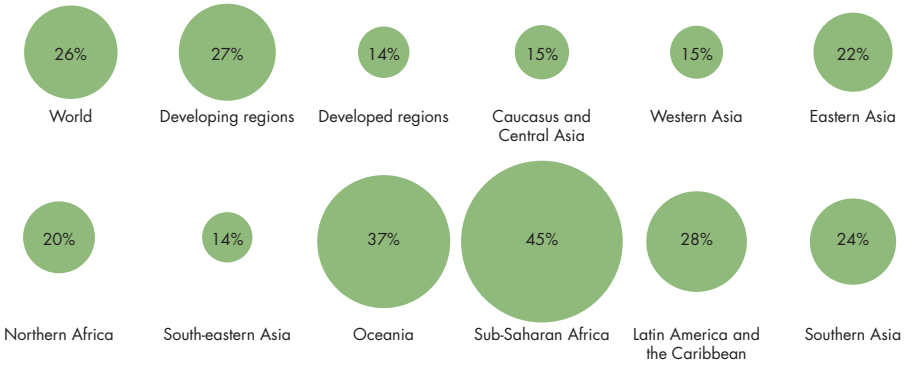
Figure 1.15: Percentage of people living below the national poverty line by region.



Source: UN

Note: 122 countries, year varies between 2005 and 2015, depending on country. Latest year available used for each country.

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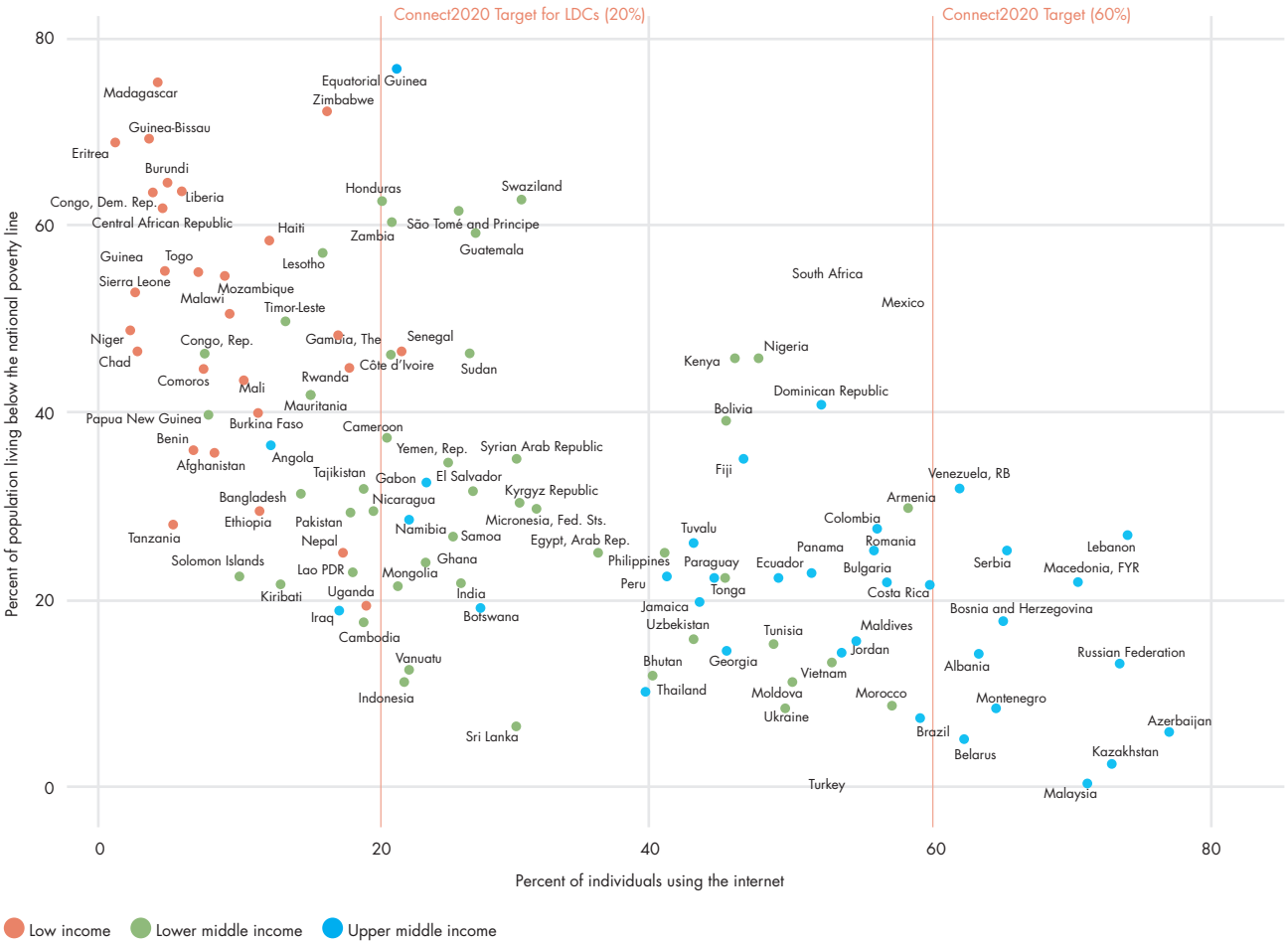
Figure 1.16: Percentage of people using the internet vs. percentage living below the national poverty line.



Sources: ITU (percentage using the internet), UN (percentage living below the national poverty line), World Bank (income groups).

Note: 113 countries (graph excludes high-income countries); data from 2015 for percentage using the internet, data from 1993-2015 for the percentage living below the national poverty line.

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of poverty. In short, access to the internet doesn't necessarily reflect reduced poverty.

Poverty and economic standing significantly affect people's ability to use information meaningfully. At the same time, access does offer an avenue for reducing poverty and creating economic opportunity, though what people can do with this access is still bounded by structural inequalities.

3.2 Gender through the lens of access to information

Gender inequality is another critical facet of the social context of access to information. As seen in section 1 of this chapter, a gender digital divide is alive and well. It is important to examine this gender gap further to understand why this gap exists by exploring gender inequality in a broader sense. Access to information can and does offer enormous benefits for more equal participation of women and girls in society, as Chapter 5 of this reports details.

Gender inequality must be addressed to achieve not only Goal 5, but all of the SDGs, as well as the Connect 2020 target. As the UN Development Programme notes, "Gender inequality remains a major barrier to human development. … The disadvantages facing women and girls are a major source of inequality." Reducing this gender gap is not as simple as distributing more smartphones and data plans to women. Araba Sey, principal research fellow at the United Nations University, Computing and Society, elaborates:

> *"To adequately address digital divides, it is essential to recognize that inequalities do not manifest uniformly across social groups. For example, the intersection of gender with other social identities (such as race, class, socioeconomic status, age, or sexuality) has a profound impact on how gender is experienced in real life (see Shields, 2009; Bilge, 2010; Warner & Shields, 2013 for more discussion of the intersectionality perspective). This has implications for how one approaches the relationship between gender, access to information, and social development" (Sey, Araba. Personal communication. May, 2017).*

This section uses the Gender Inequality Index (GII) to examine gender in the context of access to information. The GII measures gender inequalities in three areas of human development:

- Reproductive health, measured by maternal mortality ratio and adolescent birth rates;
- Empowerment, measured by proportion of parliamentary seats occupied by females and proportion of adult females and males aged 25 years and older with at least some secondary education; and
- Economic status, expressed as labor market participation and measured by labor force participation rate of female and male populations aged 15 years and older.

Our intent is not to map all the factors that exacerbate gender inequality, but to model the approach we took with poverty above. (For a more thorough analysis on gender inequality, refer to Nussbaum (2001); and for gender and ICT, refer to Hakfin & Huyer (2006), Garrido et al. (2009), and Garrido & Sey (2016), to name a few.)

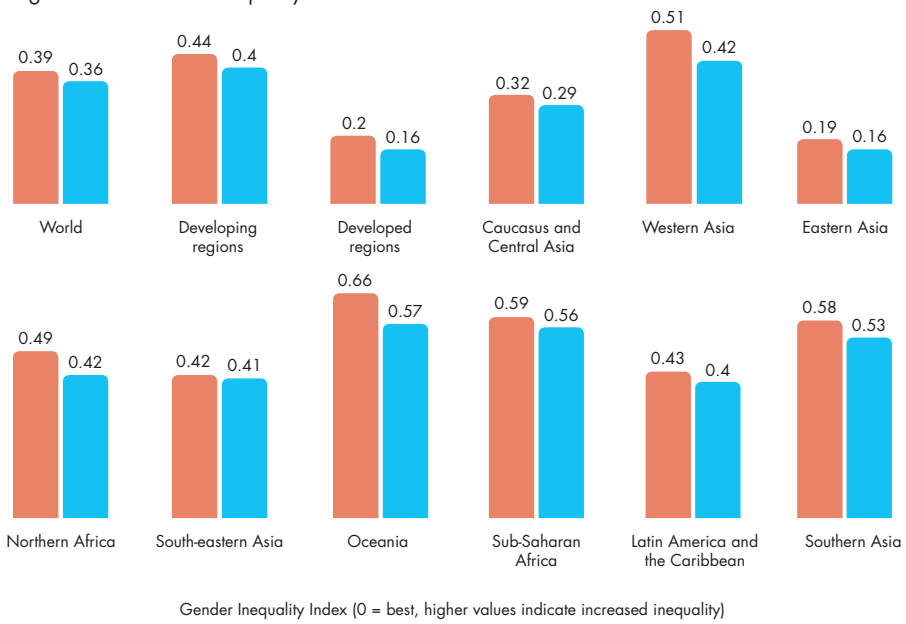
The story of gender inequality follows the storyline of economic inequality and poverty. In spite of progress, greater in some countries than in others, countries in the upper-middle-income level and below are far from reaching the targets. The GII data from 156 countries is not promising for achieving the SDGs, particularly Goal 5. Between 2010 and 2015, gender inequality across the globe, as measured by the GII, has only decreased by .03 on the GII scale of 0 to 1, where 0 represents the least inequality. Both more-developed and less-developed regions have only seen .04-point decreases. While progress has been slim overall, some regions show more promise than others. Oceania, Western Asia, and Northern Africa have witnessed decreases in inequality of almost .10, well above Southeast Asia (a decrease of only .01), Latin America, Sub-Saharan Africa, and Central Asia (all .03). Aside from more-developed regions and Eastern Asia, most of the world is far from achieving zero inequality. (See Figure 1.17: Gender inequality trends 2010-2015.)

Women need access to the internet and the resources that information and communication provide. Access promotes economic self-sufficiency for women. It allows them to make informed decisions about their bodies, their health, and their families. It is a tool that increases opportunities for employment, entrepreneurship, and social good that is increasingly embedded in everyday life – from financial transactions, to government forms, to communicating with family members abroad. However, without concerted efforts on other fronts, access alone will not achieve gender equality. Access can mean real gains for women, but it represents only a small step toward gender equality writ large.

3.3 Youth opportunity through the lens of access to information

The issues of poverty and gender inequality are critical considerations when trying to understand the full, nuanced picture of access to information, barriers to it, and opportunities it provides. Another dimension of the social context regarding access to information is youth, opportunities they do or do not have, and the implications that has on fully realizing meaningful access to information. This is especially important when considering Goal 4 and Target 4.4, to substantially increase youths' skills in order to strengthen their employment prospects. It has been widely reported that youth unemployment is high,

Figure 1.17: Gender inequality trends 2010-2015



Source: UN

Note: 154 countries (2015), 147 countries (2010)

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Figure 1.18: Percentage of females using the internet vs. the Gender Inequality Index

Sources: UN (Gender Inequality Index), ITU (percentage using the internet by gender)

Note: 78 countries, data from 2012-2015, depending on country.

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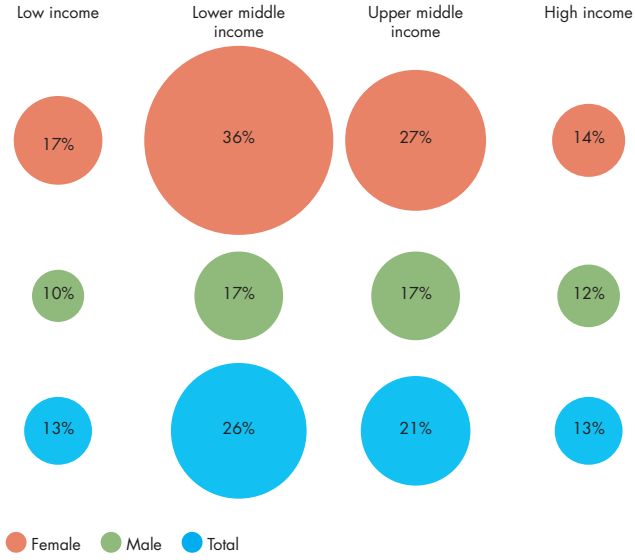
Figure 1.19: Proportion of youth not in employment, education or training by gender and income group



Source: ILO
Note: 119 countries
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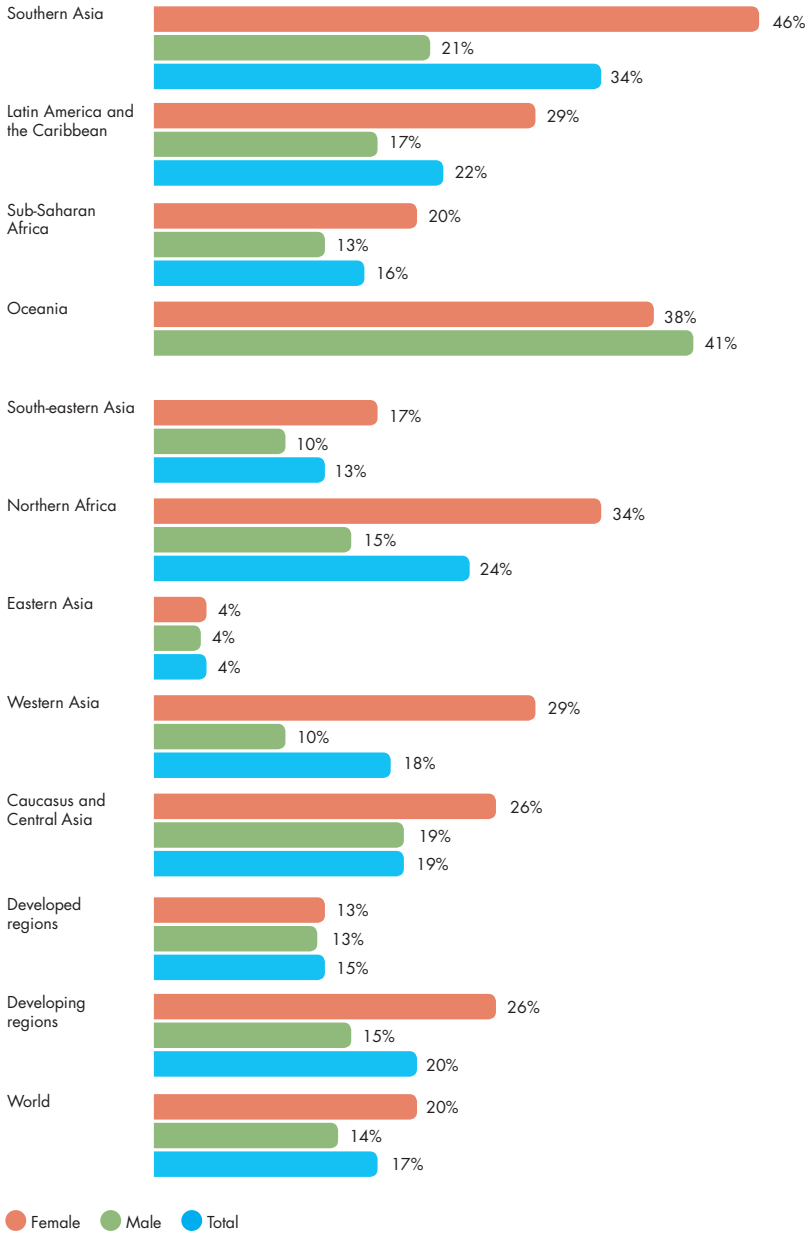
particularly in less-developed regions. The International Labour Organization (ILO) estimates that in 2014, 37 percent (about 75 million) of all unemployed people around the world were young people (Mourshed et al., 2015:11). Contributing to unemployment levels among youth are distinct gaps in accessing education and training opportunities. At the same time, it is assumed by many that access to information can contribute to developing employable skills and overall employability. However, access to information is clearly not enough if opportunities for education, training, and employment do not exist or if there are barriers to accessing them. Not surprisingly, the same trend of poverty and gender inequality increasing as income levels decrease can be seen with youth opportunities in employment, education, and training. Figure 1.19 details the share of youth not participating in employment, education, or training in 119 countries, broken down by countries' level of income. High-income countries enjoy the lowest levels of youth excluded from employment, education, and training, while upper-middle-income countries and below see higher rates of youth exclusion from opportunities. This is particularly the case in middle-income countries – both upper and lower. Eastern Asia leads the world with only 4 percent of youth not in employment, education, or training, while in Southern Asia and Oceania, more than one-third of youth are not engaged in employment, education, or training.

As Figures 1.19 and 1.20 demonstrate, gender again is a factor, with female youth far more likely to not be engaged with employment, education, or training. This inequality is particularly pronounced in low-middle-income countries. The figure below shows this most strikingly in Southern Asia, where almost half (46 percent) of female youths are not in employment, education, or training, whereas only 21 percent of male youths are not. Dramatic differences can also be seen in Northern Africa, Western Asia, and Latin America and the Caribbean. Only developed regions and Eastern Asia enjoy equality among male and female youth, and Oceania is the only place where more female than male youths are engaged with opportunities. (See Figure 1.20.)

As with poverty and gender inequality, it would seem that as internet use increases, the number of youth left behind would decrease. Largely, this is the case, as Figure 1.21 depicts, particularly in more-developed and high-income countries. However, there are again some outliers where this is not the case. This can be seen in Trinidad and Tobago, Albania, Armenia, South Africa, Macedonia, and Bosnia and Herzegovina. (See Figure 1.21 for the proportion of youth NEET compared to individuals using the internet.) While it would require additional analysis that is outside the scope of this report to understand the conditions of these different countries, it is safe to assume that there are barriers that can only be addressed with policies that increase employment, education, and training opportunities for youth.

Exploring social context, specifically poverty, gender inequality, and youth opportunity, provides a further nuanced landscape of access to information, unearthing some of the major underlying problems that must be addressed before equal, meaningful access to information can be achieved and can contribute further to meeting the SDGs. While poverty, gender inequality, and youth opportunity are just some of the social context needed to understand how complicated access to information is, these issues are not exhaustive. However, highlighting these three critical facets of social context proves that simply providing infrastructure and technical connectivity is not enough. Those working

Figure 1.20: Share of youth not in employment, education or training (NEET) by sex (%) by region.



Source: ILO

Note: 119 countries

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to understand how access to information can truly be equal, meaningful, and a significant contributing factor to the SDGs must take into account that problems of poverty, gender inequality, and lack of youth opportunity are significant barriers to realizing these goals and targets, both in regard to access to information and to development as a whole.

4. The legal context of adoption: civil liberties, political rights, and freedom on the net

Internet access is always shaped and colored by political factors, such as decisions on infrastructural investment and consumer protections. However, in many countries governments intentionally limit the internet's effectiveness as a resource for the free pursuit and sharing of information through a variety of policies and practices, such as blocking specific applications or technologies, manipulating online content, surveilling online activities, and punishing users for expressing their voices.

Excessive limits on freedom of expression matter not only because access to information is critical to the choices people make as they live their everyday lives, but also because freedom of expression is a cornerstone of civil liberties and political rights, and the relationship between these three types of freedoms are mutually reinforcing. Just as a country with strong political rights can create a safe environment for freedom of expression, freedom of expression helps protect civil liberties and advance political rights. These are principles reflected in the SDGs – particularly in Goal 16 and Target 16.10, which seeks to "ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements."

As more people around the world come online, can we say that people are experiencing greater levels of freedom of expression, civil liberties, and political rights? This analysis shows that the expectation of higher internet use leading to higher freedoms is, at the global level, not mapping out. Rather, for the majority of internet users in the world, political factors directly limit people's ability to access, use, create, and share information that they could otherwise use, whether for personal development, collective action, or any other purpose.

This section focuses on information access as it pertains to fundamental freedoms, and specifically in regard to internet use, civil liberties, and political rights. In doing so, it references the legal dimension of the framework as measured by these indicators:

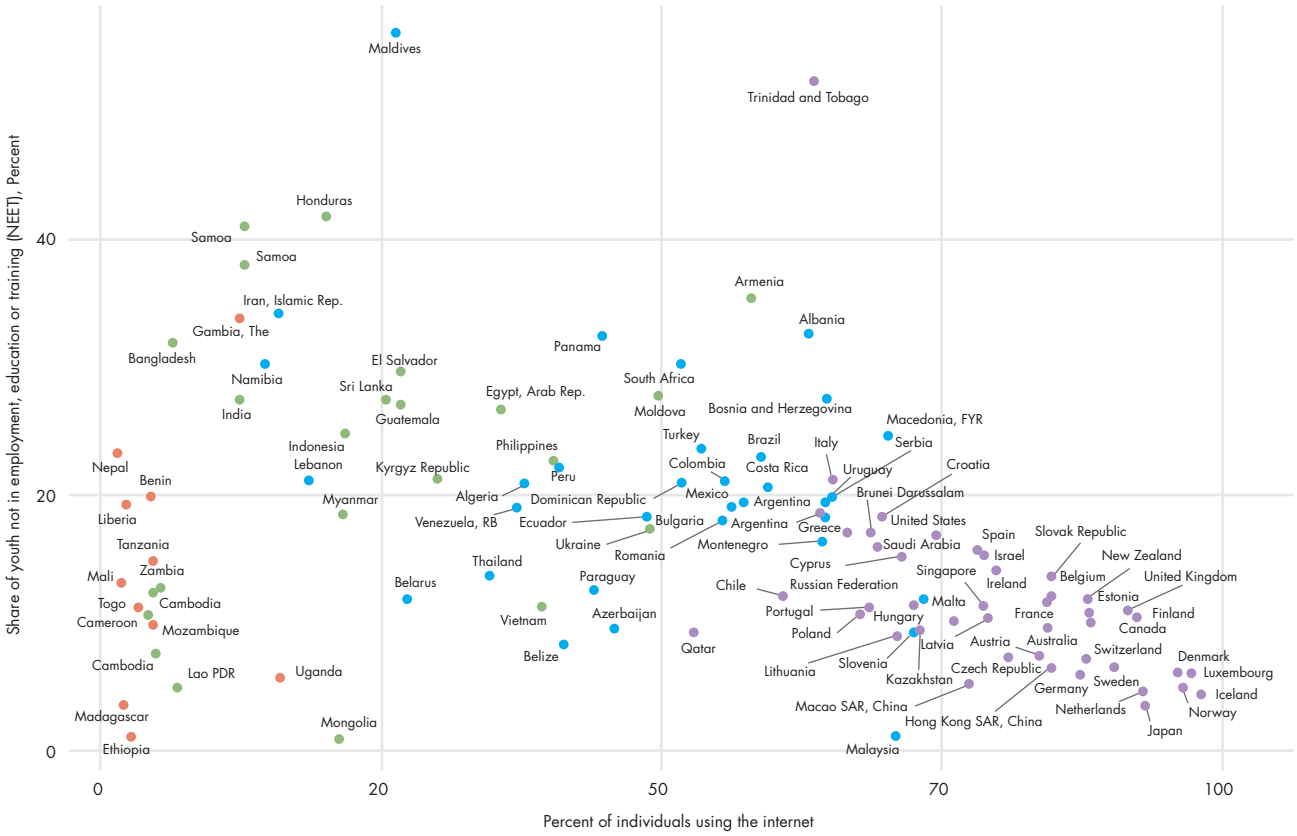
- From Freedom House, the **Freedom on the Net Rating** tracks obstacles to internet access, limits on internet content, and violations of user rights in 65 countries.
- Freedom House's **Civil Liberties Rating** rates 195 countries on civil liberties that correspond with rights protected under the Universal Declaration of Human Rights, including the extent to which people can exercise freedoms of expression and belief, freely assemble and associate, have access to an established and equitable system of rule of law, and enjoy social and economic freedoms, including equal access to economic opportunities and the right to hold private property (Freedom House, n.d.).
- Freedom House's **Political Rights Rating** assesses 195 countries on the basis of people's ability to vote freely in legitimate elections, participate freely in the political process, and have representatives who are accountable to them.
- From the Varieties of Democracy project (V-Dem), the **Freedom of Discussion Rating** measures people's ability to openly discuss political issues aloud in their private homes and in public spaces. It considers the extent of harassment from public authorities, government restrictions, and cultural constrictions.

4.1 Freedom of Expression

Information access has been espoused as a right when associated with freedom of expression. In 1948, Article 19 of the Universal Declaration of Human Rights established that "everyone has the right to freedom of opinion and expression; this right includes freedom to hold opinions without interference and *to seek, receive and impart information and ideas through any media and regardless of frontiers (The Universal Declaration of Human Rights, n.d.)*.[3] Freedom of expression has also been officially extended to the internet by the United Nations Human Rights Council in a resolution on "the promotion, protection, and enjoyment of human rights on the internet" in 2012 (United Nations Human Rights Council, 2012). Two years later, the 604 signatories of the Lyon Declaration called on UN member states to further acknowledge the public's right to access information and its importance in promoting democratic societies and sustainable development (IFLA, 2014).
What can we learn about freedom of expression when comparing offline speech (i.e. V-Dem's Freedom of Discussion score) and online speech (Freedom House's Freedom on the Net rating)?
First, we see that offline freedom of discussion seems, on average, to have been on an upward trend for the past three decades. Figure 1.22 shows the sharpest rise coinciding with the fall of the Iron Curtain in the late 1980s, as well as a downturn beginning in 2011. We do not know if the advancement of the internet (after 2005) played any role in loosening or tightening restrictions around offline discussion.

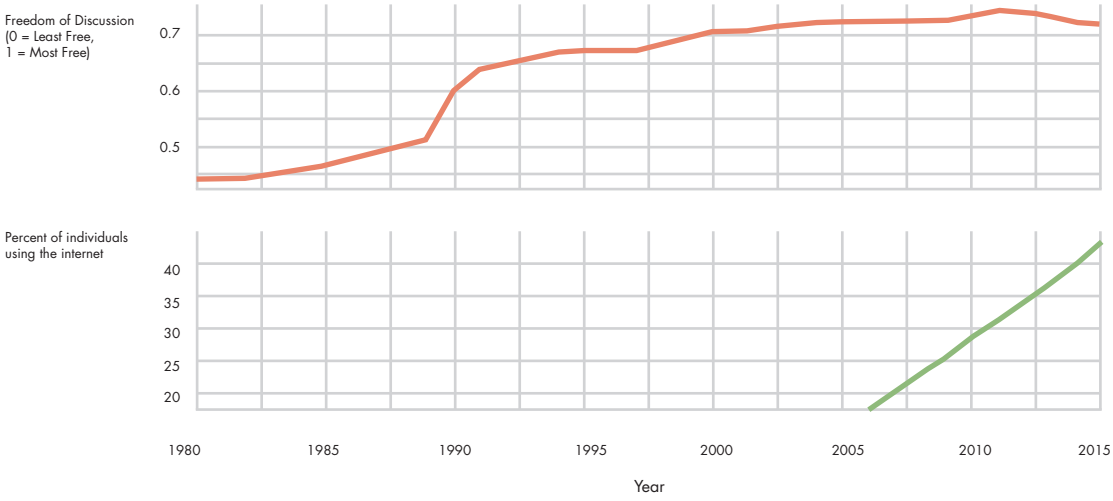
Second, it appears the freedoms that protect civic dialogue offline may also manifest online, as Freedom of Discussion scores are strongly correlated with Freedom on the Net ratings (correlation = 0.79). When plotted

Figure 1.21: Share of youth not in employment, education or training (NEET) versus percentage of individuals using the internet



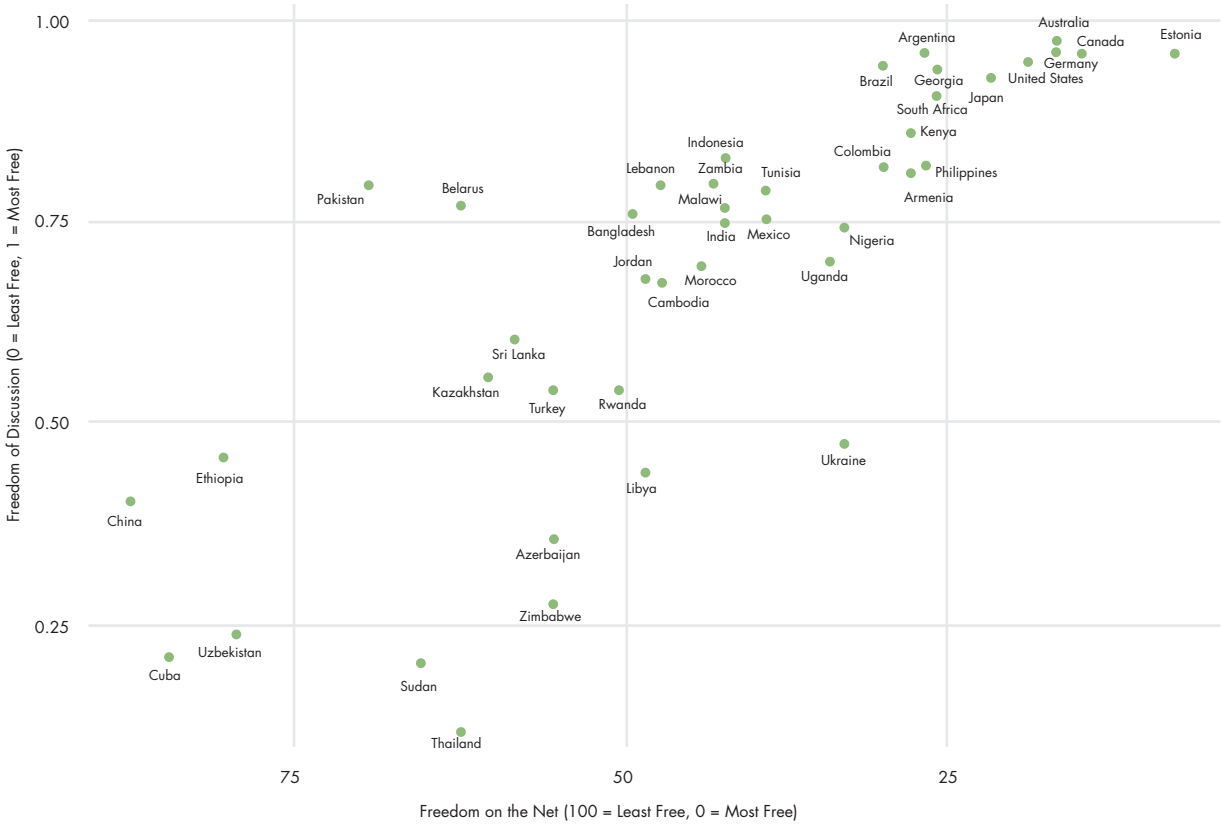
Sources: ILO (NEET), ITU (percentage using the internet), World Bank (income groups)
Note: 104 countries; data from 2007-2015, depending on country.
Technology & Social Change Group, University of Washington

Figure 1.22: Freedom of discussion vs percentage of population using the internet



Sources: Varieties of Democracy (Freedom of Discussion); ITU (percentage using the internet)
Note: 171 countries for Freedom of Discussion, 191 for percentage of individuals using the internet
Technology & Social Change Group, University of Washington

Figure 1.23: Freedom of Discussion vs. Freedom on the Net



Sources: Freedom House (Freedom on the Net); Varieties of Democracy (Freedom of Discussion)
Note: 43 countries, data from 2014
Technology & Social Change Group, University of Washington

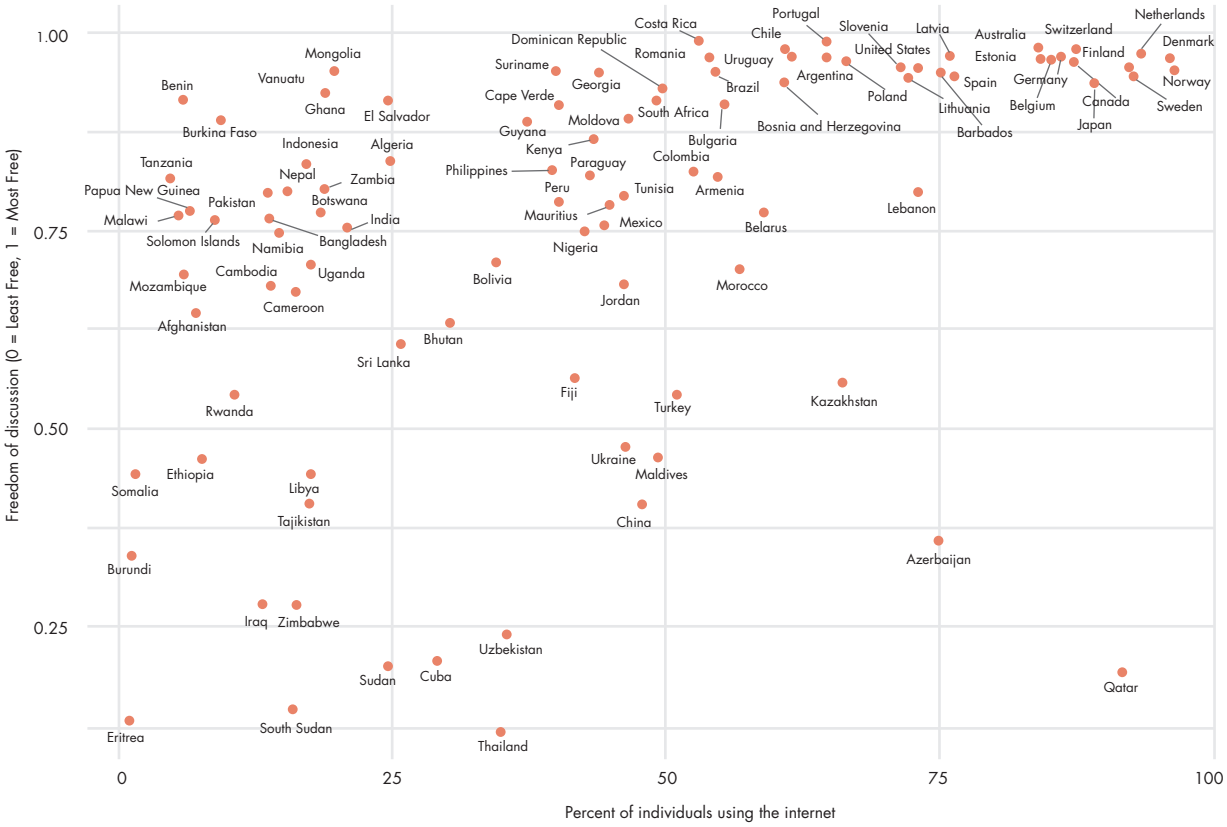
as in Figure 1.23, most countries fit within a fairly clear diagonal line, suggesting some congruence between offline and online protections. We do see several outliers, however: In Ukraine, Zimbabwe, and Thailand, (offline) freedom of discussion appears to be relatively more restrictive; whereas in Pakistan and Belarus, online freedoms of discussion are rated lower. For instance, in Belarus, the Media Law was amended, which "significantly expanded the authorities' ability to restrict critical online content, including imposing intermediary liability for illegal content posted online and the ability to block websites without court authorization" (Freedom House, 2015).

Third, higher Freedom of Discussion scores may have some relationship with the proportion of individuals who use the internet in a country. As shown in Figure 1.24, freedom of discussion seems to be a characteristic of countries that already have the majority of their citizens online (more than 60 percent online) or are working toward achieving this (more than 40 percent online). In contrast, there is a cluster of countries on the chart with somewhat high Freedom of Discussion ratings but less than a quarter of their populations online, due at least in some part to economic and infrastructural limitations. Finally, the group of countries with below average Freedom of Discussion scores vary in regard to internet penetration rates. Of these, all but two, Azerbaijan and Qatar, are countries where less than half of the population used the internet.

4.2 Freedom on the Net

According to Freedom House's 2016 report, internet freedoms have been declining for six years, with Freedom of the Net scores falling in at least half of the countries monitored each year. The implications are glaring: Freedom House estimates that, in the previous 12 months, 60 percent of internet users lived in countries where people were arrested or imprisoned for posting content on political, social, and religious issues; while 49 percent of users live in countries where people have been attacked or killed for their online activities (Internet Society, 2017). (See Figure 1.25 for a world map on the state of Freedom on the Net.)

Figure 1.24: Freedom of Discussion vs. percentage of individuals using the internet (2014)



Sources: Varieties of Democracy (Freedom of Discussion); ITU (percentage using the internet)
Note: 98 countries, data from 2014
Technology & Social Change Group, University of Washington

Do countries with a higher percentage of individuals using the internet and/or more wealth score better on Freedom on the Net? As shown in Figure 1.26, neither of these conditions alone guarantees more internet freedoms. Although a cluster of countries in the top right of the chart represents a sweet spot where high national income, high proportion of internet users, and high degree of internet freedoms are all aligned, countries are otherwise dispersed across the chart. For instance, in the bottom right quadrant we see several relatively wealthy countries (high and upper-middle income) with high internet usage that score below average on internet freedoms. These include Venezuela and Bahrain, both countries where more than 1,000 websites have been blocked and Twitter users have been punished for criticizing the government (Freedom House, 2015). Conversely, countries with lower incomes (mostly low-middle income) in the top left quadrant, such as Zambia, Indonesia, and India, were found to have more internet freedoms, but a smaller proportion of people who were actually using the internet to realize the benefits of those freedoms.

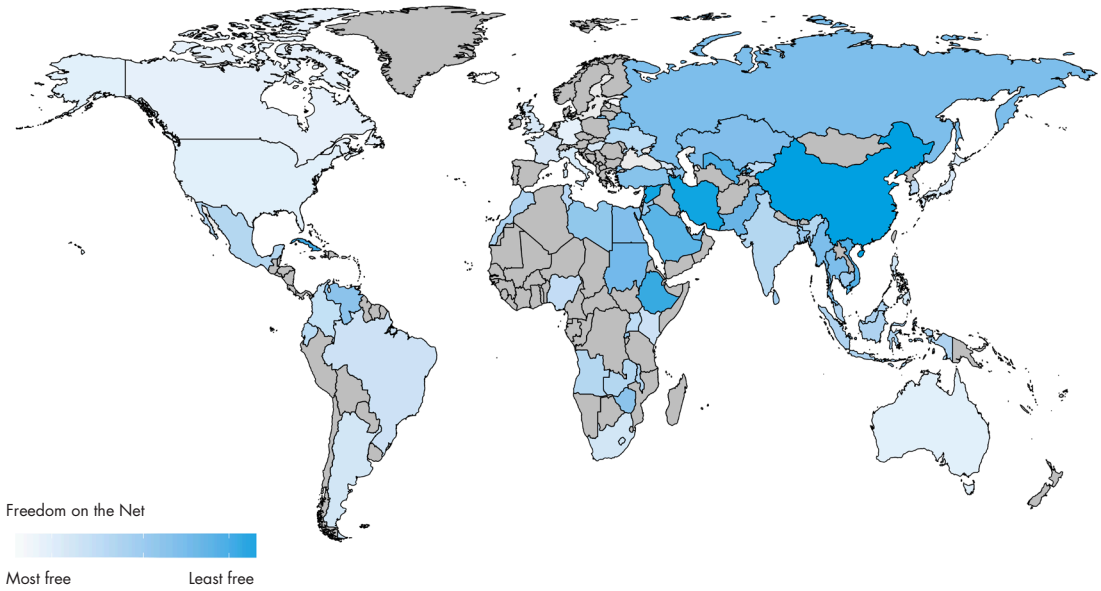
Other regional and national highlights include the following[4]:

- The Caucasus region rates well on Freedom on the Net, with **Georgia** leading among upper-middle-income countries, and with **Armenia** rated second among lower-middle-income countries, as well as having the highest proportion of individuals using the internet for its income group. And although **Azerbaijan** rates on the bottom half of Freedom on the Net, it is the only upper-middle-income country with more than three-quarters of its population using the internet.

- In South and Central America, only two countries score as "free" (i.e., with a score of 30 or less): **Argentina** and **Brazil**. Likewise in Africa, the two countries are **South Africa** and **Kenya**.

- In **Kenya** and the **Philippines**, low-middle-income countries where less than half of the population uses the internet, Freedom on the Net is quite favorable, with ratings just a few points below France and the U.K.

Figure 1.25: Freedom on the Net in the world in 2015



Source: Freedom House
Note: 65 countries, data from 2015
Technology & Social Change Group, University of Washington

- The **Kyrgyz Republic** has a relatively strong score on Freedom of the Net, unlike its bigger and wealthier neighbors, **Uzbekistan, Kazakhstan**, and **China**.

Iceland and Estonia are clear standouts, scoring the best ratings on internet freedoms by a wide margin of nine points over the next highest-rated country, Canada.

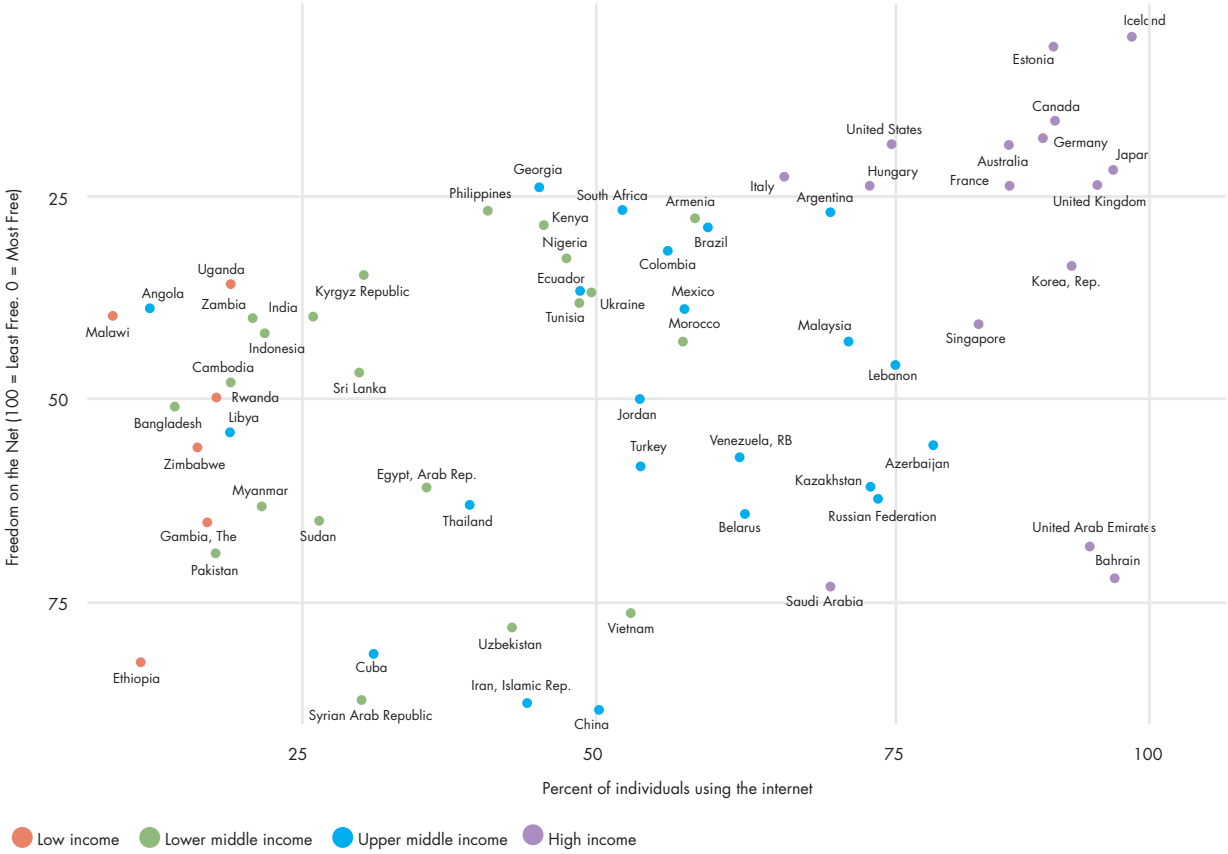
Figure 1.27 shows how Freedom on the Net ratings have changed as the percentage of individuals using the internet has changed over time, from 2011 to 2015.5 To interpret this graph, upward sloping lines indicate that as the percentage of individuals using the internet went up, Freedom on the Net also improved. Lines sloped downward are the opposite. For example, Estonia shows a steady increase in the percentage of individuals using the internet, and a corresponding steady increase in Freedom on the Net. Ethiopia, however, shows worsening Freedom on the Net as the percentage using the internet increases. Overall, Tunisia, Sri Lanka, and Georgia have seen some of the most striking improvements of online freedoms in recent years, while Turkey, Venezuela, and Ukraine show some of the largest declines. The vast differences between the shapes of these lines illustrate the complex relationship between these two indicators.

4.3 Civil liberties and political rights

At the global level, civil liberties and political rights did not change substantially between 2010 and 2015, using data from Freedom House's *Freedom of the World* project. The global average has been consistent, near 3.8 for all countries, 1.8 for more-developed countries, and 4.3 for less-developed countries (on a scale of 1 to 7, with "1" as the strongest rating, "7" as the weakest). Regionally, the biggest shifts in civil liberties were positive, with notable improvements in Western Asia (0.8 points), Sub-Saharan Africa (0.4 points), and Southeast Asia (0.4 points). However, for political rights, the biggest shifts were negative, with political freedoms declining in North Africa (0.4 points) and Oceania (0.3 points).

Given the great potential of the internet to be used to find, create, and share information, as well as regular news coverage on ways people use information and communication technologies to organize for collective

Figure 1.26: Freedom on the Net vs. percentage of individuals using the internet



Sources: Freedom House (Freedom on the Net); ITU (percentage of individuals using the internet)
Note: 65 countries, data from 2015
Technology & Social Change Group, University of Washington

action, we might expect to see access to information associated with high degrees of civic and political freedom. Indeed, Freedom House reports this is happening in some areas:

> *The internet remains a key tool in the fight for better governance, human rights, and transparency. In 2/3 of measured countries internet-based activism led to citizen-successes including: defeat of restrictive free speech legislation, advancing women's rights, and increased citizen journalism (Freedom on the Net).*

Likewise, freedom of information and expression can also be understood as a product of strong institutions and fair governmental processes.

In contrast, governments wresting political, social, or economic control from citizens do so in part by limiting the flow of information along with other fundamental rights, whether in the form of internet blackouts, blocked social media apps, or approaches such as "censorship, restrictive press legislation, and harassment of journalists, bloggers and others who voice their opinions, as well as crackdowns on religious minorities" (Freedom House, n.d.). According to CIVICUS, only 3 percent of people "live in countries where the rights to protest, organize and speak out are respected, protected and fulfilled," and serious violations of these rights have occurred in 106 countries (CIVICUS, 2017).

The story isn't so simple when we look at national data, using internet usage as a proxy for general access, creation, and sharing of information. The correlation between the "percentage using the internet" and civil liberties ratings is moderately strong (0.54), yet looking at the distribution of these scores [Figure 1.28] we see the relationship is inconsistent. Namely, countries with the strongest civil liberties ratings (i.e., rated "1" on a scale of 1 to 7) have the highest proportion of internet users in their countries (an average of 77 percent), and countries with the next strongest rating (i.e., rated "2") have the second highest proportion of internet users (an average of 52 percent). Yet for countries rated "3" through "6" on civil liberties, the proportion of internet users is similar, around 35 percent.

When examining the relationship between political rights and internet use, we see a similar pattern [see Figure 1.28]. Countries rated with a "1" or "2" in political rights have a higher proportion of internet users

than those with weaker political rights ratings. However, the proportion of internet users for countries scoring between "2" and "7" falls within a noticeably narrower range (from 48 percent to 32 percent). Indeed, the countries with the poorest political rights scores (rated "7") have nearly the same proportion of internet users (32 percent) as countries with political practices rated in the 3-6 range (i.e., those rated a "3" average 35 percent of their population online). The correlation between the Political Rights Rating and the proportion of internet users in a country is also slightly weaker (0.47) than is the case with civil liberties.

How to interpret this? Greater freedoms don't necessarily accrue in countries with higher internet penetration, ICT infrastructure, or income. Likewise, governments in low-income, low-internet penetration countries with a relatively high degree of freedom may not be adequately investing in the ICT infrastructure, affordability, and equal access required for full participation in evolving forms of freedom of expression, including digital (e.g., sub-Saharan countries and parts of Asia).

Still, there remains a concentration of countries characterized by strong civil liberties, political rights, and high online participation, comparatively speaking. They include most European countries, along with some countries in Southeast Asia, Latin America, and Oceania. It may be that they operate above a kind of threshold where these characteristics are leveraged to further advance fundamental freedoms and uphold progress toward Target 16.10. Meanwhile, countries that are not realizing the benefits of internet access and civil freedoms may be stymied from similar rates of progress.

In this section, we have demonstrated that national measures of internet usage correspond with internet freedoms, civil liberties, and human rights only in countries that score high on all of these measures. Those countries tend to be wealthy, as well. Countries with high internet use but low internet freedoms, or low internet use and high internet freedoms, generally do not achieve the same levels of civil liberties and human rights ratings as the countries that score well on both. As this project moves forward, we will continue to track the baseline indicators discussed above, including those that measure access to information (internet usage and Freedom on the Net) and those that measure the extent to which fundamental freedoms are upheld (Freedom of Discussion, civil liberties, and political rights). As countries work toward expanding their internet infrastructure, we hope to see progress not only in terms of ICT access and usage, but also in terms of freedom and equality.

5. The road ahead

Our purpose in this research was to examine the UN SDGs through the lens of access to information (the DA2I framework). This process introduced relevant indicators for monitoring the ways access to information can advance the SDGs.

We also operationalized those indicators by selecting data (as available) to establish a baseline assessment, which will be enhanced and monitored going forward. We expect future work, both ours and of our colleagues, to improve the quality and specificity of indicators, account for variations in context, and increase the availability and quality of relevant data. By documenting these trends, we hope this report will contribute to the momentum and effectiveness of policies that leverage the power of access to information.

These data point to progress in terms of expanded infrastructure, tempered by the persistent challenge of affordability of technology, particularly in settings where development needs are most acute.

We are less willing to draw conclusions regarding "progress" around other indicators in this study. The more closely we examine the data, the more strongly we want to call for better data. We don't know as much about the world as we think. While our indicators and baseline measurements are a necessary first step, we want to track these indicators and generate better contextual understandings before drawing too many normative conclusions.

This analysis represents the first, skeletal phase of measuring the relationship between access to information and development. We are mapping the bones of this relationship. Subsequent analyses will further define the contours of this relationship and flesh out the details. Toward that end, we call on researchers, practitioners, and policymakers to help advance this agenda in the following ways:

More theoretical clarity between information, access to information, and information and communication technologies. Information is an intangible resource that can be applied in myriad ways to improve life and impact development. Access to information describes the ecosystem that makes information available, actionable, relevant, and useful to individuals and communities. Information and communication technologies are a powerful delivery system, under the access to information umbrella, that multiply the scale and impact of information. Over time, as more data become available and the DA2I lens is applied and refined, we think the conceptual clarity of these interrelated concepts will improve and so will subsequent analysis and insights.

Standardized, unstandardized, overlapping, and stand-alone data. The world is overflowing with data. Advocates of evidence-based policy are blessed and beleaguered by the amount and complexity of data available. Policy agents and service providers are increasingly aware of the power of data to improve their efforts and to make the case for funding, and are increasingly partnering with researchers to gather data based on their organization and their unique setting.

Figure 1.27: Freedom on the Net versus percentage of individuals using the internet. (2011 - 2015)

Sources: Freedom House (Freedom on the Net); ITU (percentage of individuals using the internet)

Note: 28 of 65 available countries selected; data is from 2011 to 2015, depending on country. Lines show change over time from the earliest data available (2011-2014, depending on country) through 2015. Lines sloped upward indicate increasing Freedom on the Net as the percentage of individuals using the internet also increases. Color was added to lines just to help differentiate countries, and has no additional meaning. The year that data begins for each country is labeled, and each black dot in the line marks a year.

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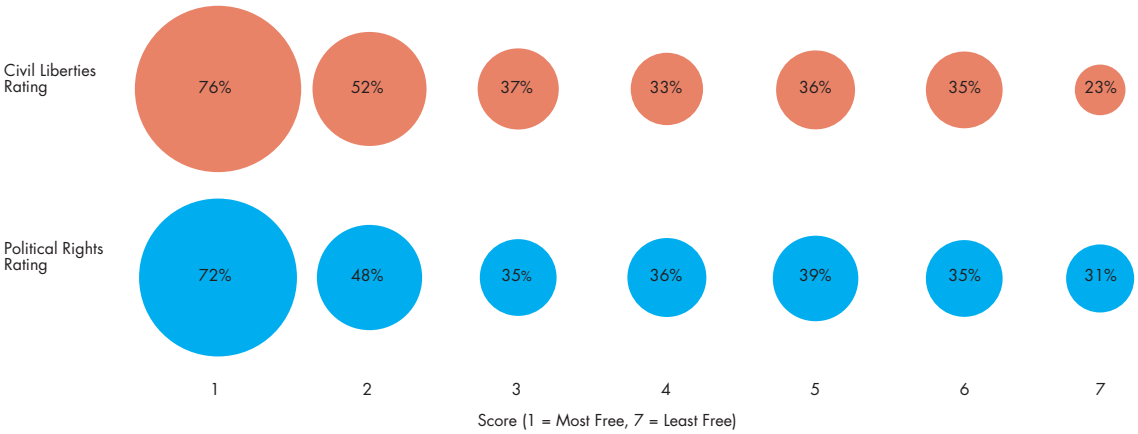
Figure 1.28: Average percentage of individuals using the internet, by sub-score on the Political Rights Rating and the Civil Liberties Rating.



Sources: ITU (percentage using the internet); Freedom House (Political Rights Rating and Civil Liberties Rating sub-scores)

Note: 185 countries

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Further, the internet and movement toward open data allow for a wealth of data to inform and complement programs generally. While we are swimming in data, the challenges of comparing data built on different questions, methods, samples, etc. are daunting.

Ultimately we are lucky that so many diverse parties value and collect data – overlapping data is an asset. Going forward, our work and the work of others who follow this lead, should explicitly grapple with the challenges of triangulating between various data sources. Because the power of information is hyper-localized, often the most important breakthroughs come from localized and customized access-to-information efforts. The challenges of generalizing and providing useful "state of access" assessments will be more useful as we are better able to use all available data and account for local differences, even as we speak to global standards.

Private sector participation. The private sector "owns" incredible data, gathered from simple choices users make about what to click, or apps such as maps that actually improve based on the number of users who participate. The more people carry smart devices around and use them, the more private companies will know. In many ways, through the aggregation of private data, companies will know more about us than we know about ourselves.

Private companies could substantially contribute to development goals, beyond the checks written as part of corporate social responsibility campaigns. They could share data. We understand the incentives not to share, but we think there is ample opportunity to collaborate with the development research community to use private data to improve life for many without reducing profits – and ultimately, as development progresses, to increase profits.

Furthermore, we expect in future years to see more data disaggregated by income, sex, age, race, ethnicity, migratory status, disability, and geographic location. Without disaggregation, averages can mask the reality of how resources and results are unevenly distributed. To achieve the foundational tenet of the UN 2030 Agenda, that "everybody counts," it is critical that the level of data disaggregation improves, as has been recognized by the Inter-agency and Expert Group on Sustainable Development Goal Indicators and most UN member states (United Nations Economic and Social Council, 2016).

Access to information can transform lives. It can help lift people out of poverty, promote gender equality, and create countless opportunities for youths. However, its transformative ability is bounded by local, social, political, and economic forces. While ICT infrastructure is key to achieving the Sustainable Development Goals, the tools that provide access to information are not enough. To help create more just and equal societies, the access must be meaningful.

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Endnotes

[1] For a complete list of organizations from whom we reviewed development indicators, see Appendix 1.

[2] Eurostat: ICT for households and individuals. http://ec.europa.eu/eurostat/cache/metadata/en/isoc_i_esms.htm

[3] This right to expression has been extended to vulnerable groups, such as children, migrant workers, and people with disabilities. http://www.claiminghumanrights.org/opinion_expression_definition.html

[4] The most recent country reports are available at https://freedomhouse.org/report/freedom-net/freedom-net-2016.

[5] For some countries, data only cover the years from 2013 to 2015.

Chapter 2:
Libraries as Agents for Sustainable Development

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2.1 Introduction

In August 2014, the international library community issued the Lyon Declaration on Access to Information and Development to advocate for the inclusion of access to information in the UN Sustainable Development Goals:

> *We call upon the Member States of the United Nations to make an international commitment to use the post-2015 development agenda to ensure that everyone has access to, and is able to understand, use and share the information that is necessary to promote sustainable development and democratic societies.*[1]

As the declaration demonstrates, librarians are aware of their broader public mission and their potential to deliver progress on development goals. Libraries are, by definition, institutions dedicated to shaping and improving access to information in the communities they serve. They draw upon their understanding of the local environment and their relationships with community leaders, local partners, library users, and non-users to develop a picture of community needs and provide the types of services that will best support their users.

On a technical level, libraries are part of the physical infrastructure necessary to ensure everyone can obtain the kinds of information they need. On a human level, libraries work to ensure that their communities have the ability to find, use, create, and share information to their greatest benefit by providing resources, opportunities for the cultivation of expertise, and social spaces for people to discuss, test, and apply ideas. For instance, many libraries provide access to government services (online or offline), act as laboratories for civic innovation, and assist patrons who are learning to use new technologies. This work has impacts across the entire sustainable development agenda, including maternal and neonatal health, entrepreneurship and business development, and agricultural development.

This chapter examines the role of libraries in contributing to the Sustainable Development Goals. It reviews the various ways libraries advance access to information, as defined in the introduction of this report, and how libraries tackle some of the access challenges identified in Chapter 1. The chapter begins with a look at the physical and digital infrastructure libraries provide, a necessary foundation for people to access both analog and digital content and services. It then turns to a discussion of the ways in which libraries build capabilities, including building the informational skills needed for meaningful application in diverse areas of life, such as education, health, and jobs. Next, it considers the role of libraries in promoting civic engagement by facilitating dialogue and other activities that strengthen civic life. Finally, it covers the library's role in building community partnerships. In the process, the chapter highlights exemplar public library programs and services around the world.[2]

The focus of this chapter is public libraries, as institutions that are embedded in communities and provide free access to information to all members of society. While the data and examples here are largely drawn from public libraries, future reports may showcase other types of libraries that provide valuable services to their target audiences – including libraries in schools, universities, government agencies, and businesses.

Of course, libraries around the world have very different capacities, both within and across countries. Recalling the DA2I framework, their operating environments differ considerably in regard to existing technical and communications infrastructure, legal and policy structures, and socioeconomic conditions. While some may be well-resourced, many others are understaffed, underfunded, and under-championed by public officials. Some have earned a reputation for innovation and providing cutting-edge programs, while others remain focused on continued delivery of traditional, well-honed services. Yet even in the face capacity constraints, libraries are accomplishing important work in their communities, and their efforts and achievements deserve recognition and repetition.

2.2 A global infrastructure

Libraries exist in nearly every country. Although reliable data is difficult to obtain, there are an estimated 1.4 million libraries across more than 200 countries. The majority of these libraries have been established in primary and secondary schools. Public libraries, which serve a broader section of society, number around 300,000, with approximately two-thirds located in less-developed countries. Another 100,000 or so libraries worldwide are composed of academic libraries, national libraries, and special libraries (Online Computer Library Center, 2016).

The value of this infrastructure is not to be underestimated, particularly when 4 billion people remain unconnected to the internet. One study that examined publicly available computers in five less-developed countries found that nearly half (48 percent) of people who used computers in public libraries, internet cafes, or other community internet points reported that the computer and internet connectivity being offered was their only means of access (Sey et al., 2013).

Yet this connectivity infrastructure does more than serve people whose households are unconnected. Studies have shown that countries with higher proportions of the population using computers at public libraries also have higher rates of home internet access. For instance, in a survey of 17 European Union countries, the proportion of people who had used a computer in the public library in Finland and Denmark (both 19 percent of the population) was more than double that of the next highest countries (Lithuania and Latvia, both at 9 percent), while Finland and Denmark also enjoy some of the highest home internet access rates in Europe (84 percent and 90 percent, respectively) (Quick et.al, 2013). In the above mentioned study surveying people in five less-developed and emerging countries, the figures were equally revealing. A substantial number of surveyed users of public libraries and other community internet points have internet at home – and in many cases well in excess of their country's average rate of home internet access. In Brazil, for example, 41 percent of people who used a public internet point also had internet access at home, compared to a national average for home internet access of 24 percent at the time of the study (2009). Similar patterns were seen in the Philippines, Ghana, and Bangladesh (Sey et al., 2013).

When speaking of public libraries as a type of information access infrastructure, it is important to remember that libraries are more than the buildings they occupy. First, the geographical footprint of a public library is often much larger than the physical footprint of the building. For instance, many public libraries have mobile libraries – buses and other vehicles that penetrate into rural and remote communities, offering books, services, and in some cases, internet access. In Namibia, a country with one of the world's lowest rates of population density, mobile libraries travel hundreds of kilometers from the country's regional libraries to loan out books, provide Wi-Fi access, and give visitors an opportunity to use a computer and printer.

Second, a library's footprint can also extend beyond the walls of the library through its digital services. Libraries of all types subscribe to digital resources – including e-books, specialized databases, and e-learning tools – that users can access from their home, school, work, or other places outside the library.

Third, a library can also be conceived of as a social space, where community members meet, participate in programs together, and learn from each other. From children's story times to cultural events, libraries offer a wide variety of programs that leverage their physical spaces as part of a community's social infrastructure.

Box 2.1: Libraries in Indonesia expanding access to information infrastructure

PerpuSeru is a public library program that has brought the benefits of information to Indonesia, a country where in 2015 only 22 percent of the population had accessed the internet (ITU, 2015). A partnership of the Coca-Cola Foundation of Indonesia, the National Library of Indonesia, the Ministry of Home Affairs, Telkom, Microsoft, and local governments across the country, the program launched in 2011 in a pilot phase by installing computers and internet and providing training to library staff in a small number of public libraries. After expanding the program to several hundred libraries since that time, it now reaches hundreds of thousands of Indonesians with a goal of reaching 1,000 public libraries by 2025. It is estimated that by reaching that goal, public libraries will provide access to information to 20 million Indonesians who had lacked it.

Source: Global Libraries Program (Bill & Melinda Gates Foundation), personal communication, March 22, 2017.

2.3 Advancing inclusive sustainable development

Physical access to the internet, books, and other information resources alone will not drive social and economic inclusion. Citizens must be able to engage with available resources, make full use of the information they encounter, learn from each other, and generate new ideas and solutions. As described in the Lyon Declaration, full access to information supports sustainable development by enabling people to:

- Exercise their civil, political, economic, social, and cultural rights.
- Be economically active, productive, and innovative.
- Learn and apply new skills.
- Enrich cultural identity and expression.
- Take part in decision-making and participate in an active and engaged civil society.
- Create community-based solutions to development challenges.
- Ensure accountability, transparency, good governance, participation, and empowerment.
- Measure progress on public and private commitments on sustainable development.

The remainder of this chapter focuses on three of the unique ways libraries contribute toward achieving the targets set forth in the SDGs while also delivering effective access to information. These include:

A. **Libraries cultivating capabilities** by developing information and digital literacy strategies and skills, allowing individuals to understand information in its context and apply and reuse it effectively;

B. **Libraries promoting civic engagement** by facilitating dialogue among community members to strengthen civic life and engagement; and

C. **Libraries partnering for community development** by building partnerships to aid in leveraging community assets for local development.

Libraries cultivating capabilities

Libraries have long played a role as enablers in individuals' paths for lifelong learning, while also fostering skill development in areas such as basic literacy and critical thinking. Yet today's learners must acquire a broader skillset to navigate the information ecosystem, including a growing list of overlapping literacies: media and information literacy, data literacy, digital literacy, and web literacy, among others. Functional gaps in any of these areas can hinder lifelong learning, skill development, and the growth of other

Box 2.2: Why libraries when a mobile phone brings the internet to your pocket?

The past several years have witnessed an explosion in mobile phone use, and today sales of smartphones eclipse those of both personal computers and feature phones in some countries. Even in Africa, smartphone sales have steadily increased, reaching an average 30 percent market penetration in the continent, with variations across countries. Why then, when the capacity exists to access the internet in your pocket, are public libraries still needed? Research shows numerous reasons. Cost, for one, is a barrier since data plans are still prohibitively expensive for many people, and serve to curtail internet use. Another reason is activity type. A study in South Africa found that "overall, mobile phones and public access computers are no substitutes for one another: each corresponds to distinct activities and information behaviors, leading to different social, academic, or professional practices." (Walton & Donner, 2012). Researching and writing homework assignments, for instance, offers a particularly obvious example, but the study also noted many other activities where the smartphone owners preferred to use a computer. It is no surprise, therefore, that many users of computers at public libraries also have smartphones.

At the same time, more and more people are having their first internet experience via a smartphone. Nearly the entire population of Myanmar is a prime example of this, going from .2 percent mobile phone penetration in 2010 to more than 75 percent in 2015, according to statistics from the ITU (2016). Recognizing this situation, the Myanmar Book Aid & Preservation Foundation, in partnership with the Technology & Social Change Group at the University of Washington, developed a mobile information literacy curriculum that more than 100 public libraries are now delivering across the country. The training helps people learn ICT skills, build critical thinking skills, participate and engage online, and discover resources outside of Facebook, the dominant destination for most Burmese (Clark, 2015).

capabilities, limiting the range of opportunities available to an individual and the broader community.

The following three examples highlight various ways libraries have developed people's skills while working toward the types of outcomes represented in the SDGs: health and well-being, entrepreneurship, and educational attainment.

- In Burkina Faso, the Girls' Mobile Health Clubs found in four village libraries expand access to quality health information while also providing support to the participants to increase their information literacy and technology skills. While library staff provide training in information literacy skills, local health clinics ensure that the health information is current and relevant, and the youth build shared information resources for their communities with the assistance of library staff ("Four Rural Libraries Create 'Mobile Health Clubs' for Teenage Girls," n.d.).
- In Indonesia, public libraries have offered micro-entrepreneurship training to more than 84,000 women and youth over the past six years. Training participants have researched a variety of ideas for small or household-based businesses, including starting or expanding initiatives related to food processing, growing markets for traditional fabric crafts, and improving methods for crop and livestock production (Global Libraries Program [Bill & Melinda Gates Foundation], personal communication, March 22, 2017).
- In Ghana, the Volta Regional Library began using a mobile library in 2012 to improve educational opportunities for students attending schools with limited resources. The program provides hands-on computer classes, addressing a subject area in which rural schools have had high failure rates in national exams. An evaluation showed that this intervention contributed to an increase of almost

Box 2.3. Libraries supporting gender equality

Many countries around the world are noticing a similar phenomenon: Women and girls are less likely to have access to ICTs than their male counterparts, and when they do have access, they use the internet less often than men. Women are also underrepresented in the ICT professions, a growing sector that is projected to provide many jobs and good salaries. This divide also extends to many of the public places people go to access computers and the internet, with men generally using these spaces in greater proportions than women (Sey & Fellows, 2009).
The digital divide between women and men is troubling not only because it reveals that many women lack basic access to information, but also because this divide exacerbates existing socioeconomic inequities, such as lower incomes and higher unemployment for women globally.

One promising exception is public libraries, where studies indicate there may be more of a gender balance, in part because libraries are seen as more welcoming to women and girls than internet cafes, and in part because many libraries provide targeted programming. In Chile, for instance, it was found that 47 percent of public library users were female, compared to only 28 percent for internet cafes (Sey et al., 2013). In Indonesia, women make up nearly two-thirds of the users at public libraries in the PerpuSeru program, while constituting a minority of internet users nationally (Global Libraries Program [Bill & Melinda Gates Foundation], personal correspondence, March 22, 2017).

The potential for positive impact is especially high for women and girls who participate in library programs designed to strengthen their digital literacy skills while supporting their livelihoods. Of the many examples available, two are highlighted below (Beyond Access, 2012).

In Myanmar, public libraries are addressing the gender gap with the TechAge Girls program. A partnership between IREX, Myanmar Book Aid and Preservation Foundation, Ooredoo, and the Ministry of Information, the program aims to develop leadership skills while providing technology training, and requires each participant to lead a community development project (Reich, 2017).

In Uganda, the National Library's digital skills training program is offered in local languages and designed for female farmers. In addition to building women's digital skills, the program helps them find agricultural information, such as weather forecasts and crop prices, and sell their products online (Beyond Access, 2012).

Such library programs are a start. However, stronger commitments from the public and private sectors may still be required for women to truly reap equal benefits from equal participation in the digital revolution.

(For more discussion on the interplay between access to information and gender, see Chapter 5 for Nancy Hafkin's essay and Chapter 1 for data on the digital divide.)

50 percent in the pass rate (rising to 65 percent from 45 percent) in information and communication technology (ICT) exams among third-grade students when compared to previous years. Based on these positive results, in 2014 additional funding supported the expansion of the program to three additional regions in Ghana. The project reached more than 3,800 students at 25 schools by the end of 2016 ("Hands on Computer Classes for Struggling Students," n.d.).

Access to information, in its fullest sense, includes the production and sharing of information and multimedia, as well as the creation of physical objects. This allows for skill-building and hands-on application of knowledge. Many libraries have introduced makerspaces, robotics classes, and other programs that stimulate creativity by providing opportunities to tinker. In this way, libraries support individuals' growth from passive consumers to active producers, as shown in the example below.

- In Germany, the Cologne Public Library renovated a portion of the main library to build a makerspace that provides access to technologies such as a 3D printer, advanced software and hardware, and additional print and physical resources used in creative pursuits. As a public institution open to all, the Cologne library is also partnering with community members to provide training through formal and informal means, further facilitating local knowledge sharing through creative activities ("Music, media, makerspace – the new services of the City Library of Cologne," n.d.).

Libraries promoting civic engagement

Libraries are well-positioned to provide opportunities for public dialogue and civic participation. With strong local roots, they are typically regarded as safe and trusted institutions in their communities, characteristics that can prove valuable when tackling challenging issues. Public libraries are often publicly funded as well, setting them up as nonpartisan intermediaries between the will of the people and the vested interests of local governments. As such, civic engagement programs in public libraries can help to strengthen civic life when they facilitate citizens working together to make a difference in their communities. The following two examples show how library programs have helped to foster a renewed sense of national identity in Colombia and advance more effective local governance in Chile.

- In Colombia, public libraries have taken an active role in reconciliation as the country tries to end hostilities with rebel forces and normalize previously militarized zones. The program, "Comparte Tu Rollo" (loosely translated as "Tell Your Story"), is a partnership between the National Library and HistoryPin, a nonprofit organization. In the program, libraries work with community members to talk about their local history, share stories of the past, and upload digital collections of photographs of their communities. In the initial stages, the National Library discovered a tremendous desire among citizens to engage in sharing personal and community stories, building a shared history, and understanding similarities and differences with other Colombians in various regions in the country. The need was greatest in regions where there had been little or no formal federal government presence. Building on Tell Your Story, the National Library is planning future programs, including facilitated community dialogues based on a curated set of media; skills development for citizens to create media that highlight issues of importance to the community; and a design thinking methodology for community members to choose a big question they want to solve and then conduct research (using physical and digital resources), debate, discuss and agree on a solution. Another partner in this effort is Libraries without Borders. The ultimate aim of these programs is to promote peaceful and inclusive societies throughout Colombia, leveraging the country's 1,250 public libraries as platforms for civic engagement (National Library of Colombia, personal communication, March 31, 2017).

- Chile offers another compelling example. Chile's public libraries have long played a role in providing access to information for its citizens, stemming back to 2002 when the BiblioRedes program brought internet access and training to more than 400 public libraries. Over the years, the country has witnessed public libraries benefiting its communities with ongoing services related to health, education, entrepreneurship, and, in times of natural disaster, emergency services. Based on this successful history, the Fundación Democracia y Desarrollo recognized that public libraries would be natural partners for its work focused on building connections between Chileans and local governments and solving local problems using facilitated dialogues. The resulting program, "Civic Engagement & Public Libraries: Fostering the Relation between Citizens & Local Governments," features a methodology that facilitates the local community in selecting a topic and developing a solution through a set of dialogues held at the library. In this way, the libraries served as civic educators, conversation starters, community bridges, and even visionaries in helping communities solve local challenges (Global Libraries Program [Bill & Melinda Gates Foundation], personal communication, multiple dates).

Libraries partnering for community development

Most public libraries recognize that partnering with other organizations is a very effective way to leverage their respective strengths and resources to achieve far-reaching impact. This is particularly the case in an operating environment where resources are limited, for the library or partner organizations. Either as single libraries or as part of a regional or national system,

libraries can serve as platforms for partners to magnify the reach and impact of their programs and services while remaining responsive to local characteristics and needs. To any partnership, libraries can bring information resources and expertise, a broad-based audience of library users, and in-depth knowledge of a local community. Throughout this chapter, many of the examples provided have illustrated the immense value of community partnerships. Two other examples worth noting include programs to address youth unemployment in South Africa and health issues and food insecurity in the United States.

- In South Africa, a partnership has emerged between the National Library of South Africa and private industry aimed at expanding ICT-related employment opportunities for youth. The program includes training in digital skills and a graduate internship program for youth to gain practical experience. The collaboration also contributes to the skills development initiatives of the National Development Agenda (National Library of South Africa, personal correspondence, March 28, 2017).

- In the United States, the Kansas City Public Library responded to poor health indicators in the communities served in an economically depressed area of the city by partnering with local health-care providers and other organizations to deliver fitness and health management classes and expand access to healthy foods (Berry, 2017).

2.4 Conclusion

The above examples – a small sample of the work of public libraries globally – show how proactive, community-centered public libraries are stepping into areas where there are information gaps and unexplored potential in local communities.

This can be as simple as expanding access through improved infrastructure, such as launching free Wi-Fi hotspots and loaning laptops, or deploying a mobile library to take access to the point of need. It can also be one of the many expertise- or skill-development training programs for women, girls, and youth focused on specific domains to ensure improved literacy, equality, health, and economic development. This can also be seen in outreach programs that target groups such as workers in the agricultural or small-business sectors to help them improve their yields, find new markets, or increase sales through more effective business practices.

Additionally, partnerships have helped libraries increase their outreach to specific segments of the community, in order to address information needs in unique ways. These activities build on the inherent capabilities of the library: its technology infrastructure, knowledgeable and engaged staff, the trust of the community, and its knowledge of the local environment, especially as it relates to access to information and needs.

However, the work of libraries is clearly affected by the environment in which they operate. When they lack broad-based support, they are less able to fulfill their mission of providing free information access to all members of society. Consequently, current users, potential users, and their broader communities miss out on the opportunities needed to build their capacities and pursue their individual and collective interests.

Libraries need the support of public partners, both in implementing or scaling programs and in shaping the policy environment. Good information access policies, in areas such as copyright and content licensing, can have dramatic impacts on the type and range of services that public libraries can provide when it comes to access to information. Likewise, special attention to libraries' physical and infrastructural needs, whether in the form of reliable power supplies (through backup generators or solar panels, for example), use of universal service funds to support high-speed internet connections, or well-designed, user-friendly facilities, are also integral.

Librarians are aware of their broader public mission and potential to deliver development goals on behalf of the wider community. Proactively identifying and delivering needed access to information can help propel dramatic changes such as improved agricultural yields, increased awareness and adoption of healthy behaviors or practices, development of effective and sustainable employment for people to improve their economic standing, and many other benefits. Traditional tools, such as mobile libraries, and newer ones, such as digital technology, allow them to increase their footprint.

Libraries welcome the opportunity to cooperate with other actors working in the development realm to go further still. For governments and development agencies, including libraries in such partnerships offers vast opportunities to reach further, and achieve more.

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End Notes

[1] For details on the Lyon Declaration, visit http://www.lyondeclaration.org.

[2] The chapter does not include the same level of quantitative analysis provided in Chapter 1, nor does it introduce library-specific DA2I baseline indicators. This is because, at present, any reliable, standardized, global data on libraries is virtually nonexistent. Fortunately, a number of regional and global data efforts are underway, which may yield better library data for analytical purposes in future DA2I reports.

Chapter 3:

A2I for Sustainable Agriculture

How access to information can help end hunger and promote nutrition

Thomas Baker, Ruthie Musker
Dublin Core Metadata Initiative

The aim of Sustainable Development Goal 2 (SDG2) is to "end hunger, achieve food security and improved nutrition and promote sustainable agriculture" (UN, 2015). Eliminating hunger and all forms of malnutrition cannot focus only on increasing crop yields. Attention must also be paid to increasing food quality and nutritional value, raising smallholder farmer incomes, empowering women, supporting ecosystem resilience in a changing climate, maintaining genetic diversity, and improving access to healthy food for everyone. These crucial components to the elimination of hunger are outlined in the SDG2 subgoals.

Currently, there are approximately 570 million farms in 161 countries. Of these, 13 percent are in lower-income countries and 36 percent are in lower-middle-income countries. Farms less than two hectares comprise 12 percent of the world's agricultural land, and family farms make up 75 percent of the world's agricultural land (Lowder et al., 2016). Forty-three percent of the agricultural labor force in less developed countries is made up of women (FAO, 2012). If sustainable agriculture and SDG2 are to be achieved, smallholders, especially women, and low-middle-income farmers must be able to access, analyze, and apply information to their production systems. Improved access to information for farmers increases the likelihood of achieving the SDG2 and its subgoals.

Open data lies at the heart of improved access to information for farmers. The Global Open Data for Agriculture and Nutrition (GODAN) initiative advocates for the proactive sharing of open data to make information about agriculture and nutrition available, accessible and usable. GODAN, along with its network of more than 500 partners who also advocate for open data, believes that open data on agriculture and nutrition is crucial to the achievement of the sustainable development goals, especially SDG2. Open data to achieve SDG2 has two aspects: 1) Farmers need open data and access to information on modern farming methods, on appropriate inputs such as seeds and fertilizers, on market opportunities, prices, weather, environmental protection, health, agricultural laws and regulations and, where appropriate, on how to apply for subsidies. To find and use such information, farmers need access to, and training in, information and communication technology (ICT). 2) Global initiatives, governments, foundations, industry, NGOs and research institutions will be able to use open data that smallholder farmers provide to make positive decisions for the food system and to ensure food security, while holding one another accountable for SDG2 monitoring.

570.000.000 farms in **161** countries, of which **49%** are in lower or lower-middle income countries.

Open data and open access to information (A2I) take several forms. It is often said that the best technology is the one that is most available. Though the internet has become the primary source of data and information in today's increasingly urban world, information is often the most helpful for farmers in rural areas when available as accessibly presented leaflets, radio shows or podcasts, videos, or webinars, or presented at community events with opportunities for interaction. Information also needs to be available in the language of farmers, which is often a local or minority language. This chapter argues that open data and open A2I are crucial for achieving Sustainable Development Goal 2: Zero Hunger. As defined in this report, A2I entails the rights and capacity to use, create, and share information in ways that are meaningful to each individual, community, or organization. We focus on challenges surrounding SDG2 and how data and information can overcome these challenges.

3.1 Obstacles to information access

Although a tremendous amount of open data and useful information exists online, farmers in less developed countries lack the education, ICT skills, and access to computers and connectivity needed to use the internet effectively to improve their livelihoods. Family farms often rely on inefficient and unprofitable methods and often operate at subsistence levels. Many farmers speak only a local language and some are non-literate. They lack access to information about markets and new farming methods that might help them improve productivity. Outlined below are several obstacles that smallholder farmers must overcome in order to not only receive the correct information, but translate that information into an actionable decision.

Access to print materials. Print materials remain the most easily accessible way to browse and consume basic information. In a time of rapid change and technological development, there is continual output of new and updated print materials. Faced with limited budgets, the providers of information to farmers and other rural citizens must choose their materials carefully. In areas that lack libraries and newsstands, printed materials can be provided through information tables set up at markets or fairs, or taken out to remote areas in traveling library vans.

Access to web materials. With the most relevant and up-to-date information available now on the web, it is increasingly important to deliver print materials "on demand," such as when a farmer downloads and prints maps using computers and printers provided by a library instead of visiting a government agency in a distant city. Taken to its extreme, print-on-demand can be offered from traveling information tables or library vans with mobile internet connections.

Access to computers. Many farmers lack basic access to computers. This is in part a very practical question, especially where electricity is unreliable, and it has also to do with lack of ICT education (see below). Libraries, and library-like rural information centers, can provide public-access computers, if necessary powered by solar panels or generators. But in an age where ordinary smartphones, each with more computing power than the 1969 mission to the moon, will be in the hands of 80 percent of the world's population by 2020 (The Economist, 2015), mobile phones will clearly become more crucial to farmers. They're needed not only for accessing information, but for creating content and for interacting with expert help services (see below).
Face-to-face access to experts. Information is sometimes best digested not when consumed in silence, but in face-to-face situations that invite questions. Examples include plant-clinic tables set up in village markets and presentations hosted at libraries or at fairs. Screenings of video documentaries or webinars, whether in libraries, tents at fairs, or mobile vans, provide opportunities for discussion. Farmers may find a long trip to a nearby town worthwhile if they can meet other farmers and ask questions. Face-to-face events are especially helpful to non-literate farmers.

Family farms cover **75%** of the world's agricultural land
(Lowder et al., 2016).

Access to information tailored to local needs. One might assume that farmers who grow the same crop or live in areas with similar climates can benefit from the same technology, but other factors, such as culture and social structure, must be considered if technological solutions are to be sustainable.

Access to information in local languages. Farmers are more likely than other population groups to require information in local or regional languages. Some projects have developed video documentaries on farming methods explained by farmers in their local language, developed PowerPoint presentations, or repurposed the presentations as leaflets for distribution from mobile information tables or at farmers' meetings.

Access to facilities and training for creating videos. Lessons and experience about topics such as farming methods, health, accounting and taxes, and available subsidies can reach wider audiences in the form of documentary videos and educational webinars. To produce such materials with today's technology, it is enough to have a laptop with video production software, some digital cameras and voice recorders, a projector and screen. Training is required to use such equipment effectively.

Access to ICT training for farmers. To find and access up-to-date information on their own, to communicate with other farmers or with experts, and to manage family finances more efficiently, farmers are helped by training in internet search, email, and spreadsheet software. More advanced ICT training topics include video production for documenting farming practices and desktop publishing for creating leaflets and marketing materials.

Access to information in remote areas. Farms in rural areas do not have the same resources as those who live close to urban centers. Farmers in remote areas can sometimes be reached by radio broadcasts; however, technology can also be brought to the remote villages with mobile buses or vans. Such mobile units are typically equipped with computers, mobile internet, and collections of selected print materials. Some mobile units are used for traveling computer labs or for information tents at agricultural fairs.

Access to information and assistance with markets. In order to ensure a sustainable income and fair prices for their products, farmers must receive correct access to markets and market information either through a smartphone, audio message, or another method that is culturally appropriate for the farmer.

Training for volunteers. In the low-resource conditions of many farming communities, information access initiatives typically require the mobilization of volunteers, and volunteers must also be trained. Examples include the training of volunteers in using smartphones to transmit information from the field for diagnosis by experts, and the training of facilitators for workshops, information evenings, and computer labs.

Building partnerships. Partnerships are essential to achieve SDG2. Local initiatives, community libraries, national libraries or library associations, local or national agencies, extension services, NGOs, research institutes and universities, international organizations, industry, and governments must work together for success and sustainability.

3.2 Initiatives to increase farmers' access to information

The following examples show a range of A2I initiatives that have improved agricultural production and farmer livelihoods through available technology. A2I is important to the farmer at all stages of agricultural production. Information can be used to decide which crops to grow and how to price them for the market; and it is essential to promoting the importance of nutrition. Specifically within crop production, farmers face various challenges that A2I can improve, including changeable weather, plant health, pests and diseases, and access to a consistent water supply. Farmers should be able to record their own data to plan for the future, and may require ICT infrastructure or internet connectivity, and sometimes even electricity. Even after farmers have access to mobile phones and internet connectivity, they require training and extension services, in local languages, to build capacity.

3.2.1 A2I for land rights

Improving transparency of land rights with a digital registry (Rwanda). In Rwanda, farmers did not have exclusively named land rights, resulting in conflicts among neighbors and time lost to resolve disputes. The government of Rwanda has developed a nationwide, digital-based land registry system, Rwanda Natural Resources Authority (RNRA), which is both online and machine-readable. RNRA is the first large-scale land registration program of its kind in Africa. The system has improved income security for many rural citizens, stimulated a new wave of rural development, improved access to credit, and promoted investment in new businesses. Due to RNRA, all records are digital rather than physical, saving time and money. Mortgage approvals are automatically recorded, tax gathering is streamlined, and 84 percent of land has identifiable owners. This digital registration system plays a key role in creating social cohesion and helping to increase agricultural productivity. RNRA has resulted in reduced conflict, and more time for strategic development. Additionally, women can formally register as landholders (GODAN, 2016).

The Haller Farmers App uses 60 years of data to help farmers increase yields during inconsistent weather. 80% of the farmers involved were women, 42 000 people in total were impacted by the app.

3.2.2 A2I for decision-making and farming practices

Smartphone app for decision-making (Kenya). In Kenya, the Haller Foundation has developed the Haller Farmers App, which has organized 60 years' worth of farming data and expertise into a usable format for smallholder farmers. The app draws data and results from a local test farm. The information is provided openly in both English and Swahili in text form, with Swahili also available in audio format. The Haller Training and Demonstration Farm trains farmers on innovative agricultural techniques for sustainable living. Farmers receive face-to-face advice and information tailored to their local needs. The app has taught farmers how to increase their yields during inconsistent weather. One farmer has begun to terrace his crops, which are now surviving both rains and droughts. Haller also helps farmers to combat pests using organic pesticides that do not damage the soil, and to build dams to ensure consistent availability of water. Numerous success stories show that because farmers received advice on optimizing farming practices through the Haller app, they have excess money to feed their families and can send their children to school. In 2015, 42,000 people were impacted by the Haller Foundation, 80 percent of the farmers were women, the app had 10,000 unique users, and 1,724 farmers were trained (GODAN, 2016).

Helping farmers with satellite data and extension services (Uganda). The Market-led, User-owned ICT4Ag Enabled Information Service (MUIIS) based in Uganda is an extension service provided to farmers that includes data, knowledge, and advice to help farmers make effective decisions. Through the platform, farmers have access to assistance, as well as advice on crop insurance. This platform incorporates several partnerships from both the public and private

sectors, and includes LEAF Competence Center (eLEAF), EARS Earth Environment Monitoring (EARS-E2M), aWhere Inc., the Technical Centre for Agricultural and Rural Cooperation (CTA), the Alliance for a Green Revolution in Africa (AGRA), the East African Farmers' Federation (EAFF), and Mercy Corps Uganda. The project is funded by the Dutch Ministry of Foreign Affairs (MFA) through the Geodata for Agriculture and Water Facility (G4AW) of the Netherlands Space Office (NSO). MUIIS further empowers the farmer because the ICT product is owned and marketed by farmers. It is targeted at 350,000 farmers across Uganda, 35 percent of them women. Although the project is in early stages, MUIIS hopes to see a crop yield increase of 25 percent, and farmer incomes increase by 20 percent (CTA, 2016).

Connecting rural community libraries to the internet (Uganda). The Connect Uganda Pilot Project supplied each of five rural libraries with three netbooks and internet connectivity. Seven hundred farmers were trained to use ICT to search the web, where they could find available open data and information to learn about new species of plant, for example, or sources of tools. In the three libraries that lacked electricity, the project installed solar panels, which also allowed them to hold meetings and support internet access at night. The project partnered with the Uganda Community Libraries Association, a center for lifelong learning, and government farm support agencies. Ten volunteers were trained to organize monthly information meetings and to help non-literate farmers. When farmers learned about a disease-resistant coffee plant, librarians helped the farmers petition a government agency for seedlings. Librarians translated information from national farming agencies into local languages. They helped farmers start a blog and portal to market their products (EIFL-PLIP, 2014c).

Helping farmers improve plant health (worldwide). Farmers need information about plant pests and plant diseases, often in response to infestation or other urgent problems. Plantwise, a program led by the Center for Agriculture and Biosciences International (CABI) in the U.K., aims at helping farmers achieve higher yields through combating plant health problems. In partnership with national agricultural advisory services, Plantwise has established a network of more than 1,800 plant clinics that are run by more than 5,000 trained plant doctors in 34 countries. Clinics often take the form of information tables and poster boards that can be moved easily between town squares, village markets, and locations in the countryside. Farmers approach the tables with samples of their sick or diseased crops. Plant doctors use tablet computers and internet connections to access the Plantwise Knowledge Bank, an on- and offline open access resource for plant health information providing science-based research, with accurate and helpful recommendations for treating the conditions. Plant doctors' recommendations are continuously monitored through the Plantwise Online Management System to ensure that information passed down to farmers is correct and up-to-date. They can often supply farmers with printed information sheets. Users can find diagnostic resources, new research results, pest alerts, best-practice pest management advice, and plant clinic data analysis for targeted crop protection. With 200 partner organizations worldwide, it has been estimated that 4.5 million farmers have been helped (CABI Plantwise, 2017).

Bringing information to farmers in remote areas (Chile). Farmers in remote mountain villages of southern Chile have limited access to information about modern farming methods. A van equipped with a computer lab for teaching ICT skills can reach isolated farming communities and allow farmers to interact with experts on local radio stations. The ICT training, attended primarily by women farmers, covers internet search, use of an existing social network platform where farmers exchange experience and news, and use of an online market where farmers advertise their produce. The van also offers ICT training, which was developed with the help of youth interested in ICT and is offered to the broader community at its main location in town. A special area is dedicated to farming, with relevant literature and a room for meetings and presentations on farming methods. The facility has increased its collection of farming materials with help from agricultural organizations and the Ministry of Agriculture. Other partners include the Inter-American Institute for Cooperation on Agriculture (IICA), which supplies ready-made programs on farming; the municipal government; a regional development agency; and a university that is developing a text messaging service for farmers (EIFL-PLIP, 2014b).

Producing and screening videos on farming practices (Asia and Africa). Even if agricultural information and data is available openly, dissemination of information can be difficult in rural areas. Digital Green helps provide open data to farmers in a usable and culturally appropriate way. The organization has developed a participatory approach using open national sample survey data to study the effectiveness of knowledge sharing among peers. Using this information, Digital Green has worked with local women to develop videos that provide information on field operations, improved agricultural practices, and performance targets. One million farmers in more than 12,000 villages in nine states in India have watched these videos on mini-projectors that are brought to the villages. Four thousand videos in have been produced in 28 languages. Data is gathered about the dissemination of the videos, as well as adoption of the procedures described in the videos, and community interest is gauged to further tailor the videos to the appropriate audience (GODAN, 2017).

Helping rice farmers with low-tech cardboard information wheels (Thailand). Although the above examples show situations where it is possible for computers and the internet to reach farmers, sometimes this is impossible. In these situations, there must be alternative ways to provide a farmer with information and the benefits of open data. In Thailand, there are large amounts of data for Thai agricultural researchers

or companies that have access to computers, but there is no way for the least-resourced farmers to benefit from this data. To present information in an accessible way, the Hia Chai Rice Seed Center has designed a cardboard rice wheel. The wheel helps farmers to know when to grow their rice and when to harvest, based on the weather and the variety of rice grown. Due to the rice wheel, yields of rice increased by 10 percent (GODAN, 2016).

A2I doesn't need to be high-tech – the Hia Chai Rice Seed Centre in Thailand uses information wheels made of cardboard to make information about when to sow and harvest accessible. The project has led to yield increases of 10%.

3.2.3 A2I for rural data management

ICT training for women farmers (Uganda). In the Nakaseke district of Uganda, women farmers only speak the local language and do not have the ability to record their own data that could potentially be used to assist decision-making both at the local and government level. In 2012, the National Library of Uganda started the Electronic Information Empowering Women Farmers service in a central village of the farming district. A $15,000 grant from EIFL-PLIP paid for computers and mobile phones. An ICT training course was developed, including a manual in the local language. Sixty women attended the regular computer classes, which were held at the end of the working day in a local school. The training course, developed by NLU in the local language, covered internet search, email, Facebook, and record-keeping in Excel. The project also developed a text messaging service, training two youth volunteers with an interest in ICT to broadcast regular alerts about prices and weather. Partners in the project included the National Library of Uganda, a local school, and a community telecentre. In response to demand, the project organized ICT refresher courses and expanded its program to include men (EIFL-PLIP, 2014d).

3.2.4 A2I for market information

Electronic commodity exchange for farmers (Ethiopia). Receiving correct market information is necessary for knowing the best prices for a product. In 2008, in Ethiopia, farmers only received 35 to 38 percent of full export price. The Ethiopian Commodity Exchange Network (ECX) is an electronic commodity exchange for farmers that, through open data, gives open access to the price of crops and ensures the seller gets the correct price on a given day. Increased knowledge reduced the trader margins by half, with the farmers receiving increased revenue. This network has increased incomes for growers, and has reduced middlemen and commission charges. Market actors access real-time pricing for commodities, and information is accessed through SMS, telephone, electronic displays, the ECX website, TV, radio, and newspapers in four languages. The ECX includes warehouse management and quality certification, and guarantees payment against delivery. In 2012, 70 percent of the 1.2 million users were rural (GODAN, 2016).

Helping farmers reach new markets (Serbia). Farmers in central Serbia lacked the computer skills and network connectivity needed to access information and market their products. After years of war in the 1990s, followed by economic recession, four village libraries that existed in name only, gathering dust, reinvented themselves as information centers through the AgroLib-Ja project. In 2010, the libraries purchased computers with a grant from EIFL-PLIP and offered free internet access. As the project wrote, "Through AgroLib, we wished to overcome the traditional idea that libraries are places where you work with books." The library provided ICT training both for farmers and for the librarians themselves. It developed a website for the AgroLib project and a portal where local products could be advertised. Users of the product portal received their own business cards, with the AgroLib logo, which had the effect of advertising AgroLib at agricultural fairs around Serbia and abroad. Videos about project activities were posted to YouTube. The library also acquired up-to-date agricultural literature and hosted presentations by ministry officials about relevant regulations and available subsidies. When events were covered by local television stations, farmers enjoyed appearing in the news. In villages with few other venues for socializing, libraries also attracted young people. At project end, AgroLib received a further grant from the Ministry of Culture to extend its activities (EIFL-PLIP, 2014a).

43% of the agricultural labour force in developing countries are **women**.

3.2.5 A2I for nutrition

Teaching rural teenagers about good nutrition (Uganda). Teenagers in rural Uganda need basic schooling in good nutrition habits and sexual health. In 2014, the Uganda Community Libraries Association worked through five community libraries to institute Youth Leadership Groups, which held weeklong training camps on health, reading, and ICT skills [UgCLA]. The

camps included training in basic internet search and critical assessment of open data and information on personal hygiene, diet, and nutritionally sound farming. Vegetable gardens and fish ponds were created to exemplify nutritional principles. The youth leadership groups and camps made the libraries known in their communities as providers of informal education, and the libraries advised 30 other libraries eager to learn from their experience (EIFL-PLIP, 2015).

3.3 SDG2 subgoals and access to information

Sustainable Development Goal 2 will be achieved by the fulfillment of the subgoals, outlined below (UN, 2015). Thus, it is pertinent to ensure that the examples elaborated on above specifically answer to the subgoals. Please note 2.b and 2.5 are not included.

2.1. Ensuring access to food. By 2030 end hunger and ensure access by all people, in particular the poor and people in vulnerable situations including infants, to safe, nutritious and sufficient food all year round. Many of the farmers described in the examples benefit by increased access to information in two ways: 1) They grow more products and can feed themselves; and 2) they can sell more products, receive a higher income due to increased access to market information, and can buy more food for themselves and their families.

2.2. Ending malnutrition. By 2030 end all forms of malnutrition, including achieving by 2025 the internationally agreed targets on stunting and wasting in children under five years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women, and older persons. In addition to not having enough food, many farmers do not have the correct type of food to ensure adequate nutrition. By growing more diverse crops and having the capacity to plan for their planting and harvesting, while also protecting against pests, farmers and their families will be able to benefit from more nutritional diets. Additionally, with access to better market opportunities and fewer middlemen, products will reach the consumer in less time, reducing nutrient degradation.

2.3. Doubling the productivity of small-scale producers. By 2030 double the agricultural productivity and the incomes of small-scale food producers, particularly women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets, and opportunities for value addition and non-farm employment. Through open data and open access to information, incomes of small-scale farmers will increase due to early warning systems, advice on when to grow crops and harvest, and improved access to market opportunities. The above examples show the empowerment of women through increased ICT skills and the ability to register land. Videos and libraries, which host important and useful information, increase knowledge sharing and propagation.

2.4. Ensuring sustainable food production. By 2030 ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters, and that progressively improve land and soil quality. All of these examples seek to improve the food production systems and increase agriculture resilience especially in the face of climate change. These examples focus on farmer livelihoods as well as environmental sustainability and ecosystem protection. Satellite data, which can help farmers predict climate behavior and adapt for the future, is one of the primary sources of open data. Several of these examples help farmers receive more information on pesticides and fertilizers, making them better able to preserve soil health.

2.a. Investing in productive capacity. Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development, and plant and livestock gene banks to enhance agricultural productive capacity in developing countries, in particular in least developed countries. Most of these projects have been internationally funded, which demonstrates international cooperation in infrastructure, research, technology and gene banks. All of these projects are occurring in less developed countries.

2.c. Support food commodity markets. Adopt measures to ensure the proper functioning of food commodity markets and their derivatives, and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility. Several examples discuss how open data and open access to information improves farmers' access to market information. It is unlikely that this subgoal will be achieved without open data and knowledge sharing through the appropriate mediums.

Conclusion

Access to information and open data is key to achieving Sustainable Development Goal 2 and its subgoals. In the face of unique obstacles to equal access for smallholder farmers, the availability of the internet in rural areas can narrow the gap, though access to information and open data alone does not suffice if sociocultural issues and farmer needs are not sufficiently addressed. Nor does achieving SDG2 rely entirely on improving access to information for farmers. Farmers can themselves provide valuable data to researchers, industry, policymakers, and NGOs, raising complex issues of data ownership, privacy, and security. The Global Open Data for Agriculture and Nutrition (GODAN) initiative envisions a global data ecosystem, produced and used by a diverse set of stakeholders, that would address these challenges

of a global shared data and information space. Such an ecosystem would benefit and include everyone involved in the food system.

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Chapter 4:

A2I for Better Health

How access to information can help ensure healthy lives and promote well-being

Simon Chaplin
Wellcome Trust

Can information make us better? Not simply better informed, more engaged, and better able to contribute to productive, equitable, democratic and sustainable societies, but healthier? What role does access to information play in helping us collectively and individually achieve UN Sustainable Development Goal 3, which seeks to "ensure healthy lives and promote well-being for all at all ages"? And what role do libraries play in this delivery, as reliable information providers, responsible facilitators of access to information, as trusted spaces for engagement, and as active advocates for and agents of good health?

It is hard, of course, to separate the health benefits of A2I from the wider social, cultural and economic benefits it brings. At a fundamental level, A2I helps create and sustain stable, transparent and accountable societies in which basic human rights to health and well-being are more likely to be recognized. Improvements in education, facilitated by A2I, drive economic development. Where the latter is managed responsibly, in balance with concern for long-term sustainability and with economic benefits equitably distributed, it creates the social and structural conditions for a healthy society. Clean water, access to healthy nutrition, security, housing – all have a profound impact on health and well-being, and A2I can have an underpinning role in each. But there also are some more specific health benefits that stem from both A2I and libraries, and it is worth focussing on what these are, and how they can be maximized.

4.1 Types of health information

Before looking at the role of libraries, let us reflect on what kinds of information might play a role in improving health. Three categories spring to mind. The first is the fundamental research from across medicine, science, social science and humanities that helps us understand the biological, social and cultural determinants of health and the pathways to its improvement. The second is material produced specifically for the purpose of improving individual and collective public health and well-being, frequently described as health education or consumer health information. The third category is the contextual information, such as current affairs or national statistics, that enables citizens to hold to account those responsible for delivering health care and provides the background for informed decisions about both personal health and public health policy.

The Sesigo project in Botswana delivered **Internet-connected computers** and staff training to provide tailored help to people diagnosed with **HIV/AIDS** through libraries.

Health research

None of these information categories is novel, and in physical form all have traditionally been the stock in trade of libraries. But the transition to digital has fundamentally changed the way we produce, distribute and consume information, while a combination of digital technology and the growth of human society has exponentially increased the amount of information produced. Numerous studies have suggested a long-standing exponential growth pattern in the number of scientific research papers published, with one analysis estimating a doubling every nine years (Bornman & Mutz, 2015). The U.S. National Library of Medicine's MEDLINE® service, which indexes only biomedical

research papers, shows a similar albeit slower trend, with citations growing from around 400,000 in 1998 to 800,000 in 2015. Increasingly, it is not only the traditional research outputs – scholarly articles and monographs – that are being made available. A combination of the relative ease of sharing supporting datasets in digital format, allied with a desire on the part of researchers and research funders to ensure transparency and reproducibility of research findings, has meant that traditional publication now accounts for only the tip of the iceberg regarding health research. As we look to the future, it is becoming evident that "big data" – massive datasets, generated through programmatic analysis, and manageable only through programmatic manipulation – will fundamentally transform the nature of research, with huge potential benefits to population and individual health, but also profound implications for personal data privacy and accountability (Schadt, 2012; McKinsey & Co., 2015).

4.1.1 Information for health education

Consumer health and health education is a more heterogeneous category. While there is no evidence that the amount of health information has been disproportionately increased by the digital revolution, the simple proliferation of all information forms has had inevitable consequences.

At one end of the spectrum, health education has been both enhanced and complicated by the growth of the internet, allowing more organizations to put more information into the public sphere, but with the inevitable challenge that quantity brings in terms of conflicting messages and variable quality. Health educators have sometimes been slow to recognize the changing patterns of media consumption, especially among younger people, and this affects the targeting of health messages.

At the other end of the spectrum, conventional publishing formats such as books, newspapers, magazines, and broadcast media have been significantly disrupted but not yet eclipsed by digital channels. In some cases, lower barriers to entry – in e-book publishing, for example, or online video – have enabled many more people to participate as producers as well as consumers of information. Again, one consequence has been a challenge to quality and authority. One feature of online platforms such as Amazon is to reduce the value of publisher's brand as a factor in determining purchase. Similarly, traditional newspaper and magazine publishers have often struggled to sustain editorial models predicated on print sales and advertising, with consequent impact on quality – particularly in science and health content.

An indicator of the scale of the change in terms of information providers is the growth of Wikipedia. Founded in 2001 as a free, collaborative reference resource, Wikipedia in 2017 has grown to include more than 41 million articles in 294 languages. It has become the de facto primary reference source for internet users – including not only those seeking information about their own health, but among many students of and practitioners of medicine (Aitken, Altmann & Rosen, 2014).

81% of library authorities in England offer access to **e-information on health** and wellbeing, and library-taught digital literacy skills play a significant role in supporting health literacy.

4.1.2 Public health data

It is harder to quantify the growth rate of public health datasets, but the amount of accessible information has increased dramatically as, in many cases, information previously only available in printed or closed digital services has been made freely available online. For example, the U.S. Government's Department of Health and Human Services' Health Data Initiative, established in 2010, has resulted in the release of more than 2,000 U.S. government datasets. Up until 1991, a researcher wishing to access health data collected by the Organisation for Economic Co-operation and Development (OECD) had to do so physically; from 1991 on, they were distributed on CD-ROM. They are now freely available online, together with previous years' datasets, thanks to the work of the OECD iLibrary (OECD, n.d.).

Such information plays a critical role in holding actors to account for their ability to deliver good health. At a global level, the World Health Organization's Global Health Observatory provides a resource to "help governments, policymakers, funders and researchers identify health R&D [Research and Development] priorities based on public health needs and ensure that funds and resources are used to fill R&D gaps," linking performance directly to the Sustainable Development Goals (WHO, 2017a). Alongside this obvious benefit to member states, it also enables citizens, NGOs and the media to hold governments to account.

The same is true of data shared on a national, regional, and local level: increased access to data improves accountability. An example is the publication of data relating to nitrogen dioxide and particulate pollution in London by the Environmental Research Group at King's College London (2017). The data has compelled both local and national government to acknowledge the scale of the health impact. As in other areas of society,

restricting access to information becomes a barrier to accountability, even if the health consequences are all too apparent, as with the Chinese government's decision to block access to independent air monitoring data for Beijing during the 2014 Asia-Pacific Economic Cooperation Summit (Branigan, 2014).

The precarious nature of public health data is not only an issue in states where an absence of democratic accountability and restrictions on the free press are longstanding concerns, as testified by the recent decision to remove information from some U.S. federal government websites. Again, libraries have traditionally been one mechanism for ensuring information security, a role now shared with digital archives such as the one maintained by the Environmental Data & Governance Initiative.

4.2 Libraries as facilitators of digital access

The Lyon Declaration identified the role of libraries, archives, civil society organizations, community leaders and the media as "information intermediaries," backed by information and communication technologies and by investment in general literacy (IFLA, 2014). The recognition that libraries are only one category of intermediary reflects the changing nature of the digital information economy. The transition from a world of print publishing to one in which many key health information sources are primarily digital has, of course, had profound implications for libraries, but suggestions of obsolescence have proved ill-founded. In many cases, the shift to digital has created a new role for libraries as disseminators and quasi-publishers of health information and data. Examples include HighWire Press, originally developed through Stanford University Library, which now provides a platform for more than 3,000 journals. Perhaps the most notable example is the U.S. National Library of Medicine (NLM), whose various digital literature services – the MEDLINE citation index, PubMed (an extended public interface to MEDLINE) and PubMed Central (a free archive of the full-text subset of PubMed) – have built on the library's historical role as a print repository and indexer (through Index Medicus and the Index-Catalogue of the Library of the Surgeon-General's Office).

The German equivalent of NLM, the Deutsche Zentralbibliothek für Medizin, has similarly adopted a publishing role with its open-access Publisso platform, covering materials such as books and journal articles, conference presentations, videos, and research data across the life sciences. Many university and research libraries have taken on management of institutional repositories, moving from being solely repositories for print to being distributors of digital information and data, working either independently or, more often, as parts of consortia. This is the case in Hong Kong, where the eight main universities work together under the Joint University Librarians Advisory Committee to allow cross-searching across their individual digital repositories. In Cuba, the infoMED service developed out of a network of health libraries to provide a shared service that now encompasses a virtual health library, training network, health news, and collaboration (Centro Nacional de Información de Ciencias Médicas, 2017).

The adaptive nature of libraries is also evident in the way they have positioned themselves as facilitators of public access to digital health information provided by others, and indeed more fundamentally to the internet itself. Recent estimates suggest that close to half the world's population has direct access to the internet. This is not to underplay the huge disparity that exists between the world's richest and poorest countries, but reflects the rapid growth of mobile data networks, circumventing the need for more costly physical infrastructure. But this still leaves a huge gulf between digital "haves" and "have nots," which libraries have been working to address since the rise of digital communication.

There are many drivers for and benefits from digital access, and these have been formally recognized since at least 2003 when the UN-sponsored World Summit on the Information Society stated that "no one should be excluded from the benefits the Information Society offers" (International Telecommunication Union, 2003). In 2011, a report to the UN Human Rights Council called for internet access to be acknowledged as a fundamental enabler of human rights, something subsequently recognized by states including Finland, Greece, France, and Spain (Beyond Access, 2012).

Through the work of programs such as the Bill and Melinda Gates Foundation's Global Libraries Initiative and the EIFL (Electronic Information for Libraries) project, supported by the Soros Foundation, libraries have been at the forefront of improving public access in countries including Chile, Jamaica, Moldova, Poland, and Vietnam. The IREX (International Research and Exchanges Board) Beyond Access initiative has also been instrumental in enabling community libraries to realize their potential as sustainable information hubs.

A global study conducted for the Technology & Social Change Group (TASCHA) at the University of Washington Information School in 2013 highlighted the general benefits arising from provision of public access to information and communication technologies (ICTs) in three kinds of venue – telecentres, cybercafés, and libraries. The study found that library users were more likely to access health information than users of the other two kinds of venue, and also more likely to report positive impacts from the health information they accessed (Sey, et al., 2013, 111-2). Provision of digital access and skills, and health improvement, have often gone hand in hand. In Botswana between 2009 and 2013, for example, the national library service's Sesigo Project to train staff and provide internet-connected computers was delivered in partnership with the African Comprehensive HIV/AIDS Partnerships and the Bill and Melinda Gates Foundation, recognizing the role that A2I could play both in helping those diagnosed

with HIV/AIDS and in helping to prevent its spread. This link between digital literacy, digital access, and health is relevant not only to libraries in low-resource settings. A study by Arts Council England (2014) found that 81 percent of local government library authorities in England provide access to electronic information on health and well-being, and that digital literacy skills promoted by libraries played a significant role in supporting health literacy and the capacity to access, use, create, and share health information.

Access to information is vital for professionals – **specialist library services to doctors** and others generated a $5 return on every $1 invested.

4.3 Libraries and open access to health information

It isn't simply a matter of making information available, however. Put simply, if health information is available only to those who can afford to pay for it, the already profound effect of economic inequity on health is only exacerbated. This is the case for much health research, which is published in subscription-only journals or made available through other licensed services.

The critical importance of open sharing of health research and data was reflected in the agreement between the NLM and the publishers of leading medical journals to lift subscription barriers and make articles and datasets relating to the 2014-15 Ebola outbreak freely available (NLM, 2014). A subsequent agreement between research funders and publishers led to a lifting of restrictions on Zika-related research, and a commitment to take similar actions in the face of future global public health emergencies (Statement on Data Sharing in Public Health Emergencies, 2016).

These moves come on top of a longer-standing commitment by many publishers to the World Health Organization's Hinari Access to Health Research program, under which 14,000 journals, more than 50,000 e-books, and more than 100 other information resources are made available for free or at reduced cost to participating health institutions (described as "national universities, professional schools [of] medicine, nursing, pharmacy, public health, dentistry, research institutes, teaching hospitals and health-care centers, government offices, national medical libraries and local non-governmental organizations") in more than 115 countries (WHO, 2017b). While the Hinari program and similar schemes covering agriculture, development studies and environmental science under the umbrella of the Research4Life program have delivered substantial benefits, they do not provide public access to research for many of the organizations identified as "information intermediaries" under the Lyon Declaration, including non-national libraries. In some countries, local agreements seek to redress this imbalance. In the U.K., for example, a 2012 Working Group on Expanding Access to Published Research Findings chaired by Dame Janet Finch resulted in a consortium of academic publishers establishing Access to Research, a service offering free on-site access to more than 15 million journal articles via libraries (Griffin, 2016).

The problem of inequality in access to information is accentuated if there are disparities in access, such that validated information – such as peer-reviewed research – is placed behind paywalls or otherwise restricted, while unvalidated or unsubstantiated information is freely available. This is true of much health information in the area of complementary medicine, where practices can range from those that are well-established and soundly evidenced to those that threaten both personal and population health. The greatest risks come from movements that seek to undermine well-tested but frequently inaccessible (to a lay user) medical research by providing free access to pseudo-scientific information, as in the U.S. with the anti-vaccination movement, which has frequently been seen as a beneficiary of so-called "predatory" open-access publishing, in which the normal checks of peer review and validation are either not applied or are inadequate.

Libraries – and more importantly trained librarians – are an important means of countering this, by assessing and validating information sources and empowering others, whether they are students, health professionals, members of the public, or policymakers, to do the same. Libraries' role in promoting and enhancing health literacy (and not just general or digital literacy) is therefore an important tool of health promotion. The economic benefits of informed access to information for health professionals have been quantified in research carried out by the Australian Library and Information Association (2014), which estimated a 5:1 return on every dollar invested in specialist health (and also legal) library services.

Yet for those libraries that are not covered by schemes such as Hinari or Access to Research, and which do not have the resources to invest in specialist subscriptions, no amount of health information literacy on the part of either librarians or their users will serve to compensate for inaccessibility of the information they seek. One of the main drivers of the Open Access movement for research publications and data is the recognition that the public good is best served by "worldwide electronic distribution of the peer-reviewed journal literature and completely free and unrestricted access to it by all scientists, scholars, teachers, students, and other curious minds" (Budapest Open Access Initiative, 2002). Enabled by, and closely linked to, the rise of digital publishing, which allows the cost of disseminating research to be shifted from consumers to

producers (or more usually, their funders), open access obviates the need for libraries pay for or manage subscriptions, and creates a level playing field in terms of information availability for anyone connected to the internet. This is not a trivial issue. Many researchers, especially (but not only) those in resource-poor settings, have argued that open access not only enhances the research enterprise but also strengthens the application of evidence-based health policies (e.g. Tambo et al., 2016). Not surprisingly, libraries and librarians have been consistent advocates for open access, and have played an important role in the implementation of open access policies and practices. For example, in Kenya, the Kenya Library and Information Services Consortium (KLISC) links universities, museums, libraries and other research organizations with a common aim of promoting open access (Matheka et al. 2014).

A key precept of those pushing for open access to health research and data has been the application of licences that facilitate reuse, something that is not true of many publisher-led access initiatives, which tend to reserve rights. While many organizations involved in health promotion in low-income settings are likely to regard this as a moot point, it nevertheless represents a barrier to responsible reuse. In a report for the WHO's African Health Monitor, Derege Kebede and colleagues have described two kinds of health information gap: the absence of knowledge, or a basic deficiency in research; and what they call the "know-do gap," or the failure to apply what is known in a way that materially improves people's lives (Kebede et al. 2010).

For example, one of the key barriers to accessibility of health information aside from its free availability is language. The licensing terms for most conventionally published research will usually allow some element of fair use (depending on jurisdiction) but will rarely allow full translation. The impact of this is often disproportionately felt in communities that speak minority languages, which may already have contributed to economic, political or health inequality. Under EIFL's Public Library Innovation program, library workers in the Butaleja district of Uganda delivered a project to train health and community workers in basic ICT skills and provided computers and internet access. However, faced with a local community in which most only spoke a local language, Lunyole, they had to go further and use their newfound access to relevant health information to create resources that were accessible to their target audience – the kind of activity that is technically only possible with non-restrictive licenses (Ehrke, 2013).

4.4 Libraries as trusted social spaces

As the Butaleja project shows, the proposition that creating public access to health information will inevitably yield health benefits is deceptively simple. A report undertaken in the U.K. for the Patient Information Forum (2013), a membership organization representing health information professionals, highlights the moral argument for providing high-quality information to the public and the economic benefit that derives from the better engagement of, and health outcomes for, those who suffer ill-health. But it also acknowledges that while high-quality information is essential to public or patient engagement, it is not sufficient. The long history of public health campaigns shows that no matter how compelling and unambiguous the evidence is, behavior change is rarely dictated by information alone. Health education professionals speak about a distinction between "clinical" and "public health" models of health literacy. The former treats a lack of health literacy as a risk to be managed; the latter describes the possession of health literacy as a personal asset (Nutbeam, 2008). The models are not mutually exclusive, and both are valid under different circumstances. However, the former can lead to a tendency to assume that the key challenge around health information lies in ensuring that it is available to be accessed: thereafter, it is the failure of the individual that prevents it being acted upon in such a way as to lead to better health outcomes. Conversely, the public health model places greater onus on the act of engaging the public and creating a shared belief in the desired outcome and its fulfilment, which is more likely to lead to preemptive adoption.

In some countries, the role that libraries play in addressing the risks associated with a deficit in public health information is enshrined in law. In Japan, the Cancer Control Act requires national and local government bodies to offer information on cancer treatment and extend advice and aid to those who have been diagnosed with cancer. Libraries play a key role in this provision, with many offering specialist cancer information services that combine digital and physical resources (Miwa et al., 2016). Legal obligation aside, one reason why libraries have continued to play an important part in information access despite the growth in individual access to the internet is therefore their role as organizations that sit within, and are trusted by, their communities, a fact acknowledged by the 2013 TASCHA study. In 2009, South Korea – a country with one of the fastest and most extensive internet networks in the world – announced a major expansion of its public library network (Yoon-mi, 2011). Like many other developed countries, the Korean initiative was designed in part to help libraries become "cultural complexes," offering a range of services underpinned by the libraries' traditional role as information providers (Tack-whan & Jae-un, 2015). Research conducted in 2016 for the European Parliament's Committee on Culture and Education on the "new role" for libraries highlighted their importance as spaces for promoting social cohesion. Among the examples cited was the new public library of Arhus in Denmark, Dokk1 (which opened in 2015), which counts public health department workshops and advice services for food and health as part of its public offerings.

This rethinking of the library as community hub is not restricted to public library services. The same kinds of existential questions have been asked of research

libraries. MIT's "Task Force on the Future of Libraries," convened to help MIT "serve as a leader in the reinvention of research libraries," has posited a future in which its digital collections and services are placed at the service of a global public audience as well as a local academic one, and in which the physical space of the library becomes the nexus of a series of concentric, virtual "gathering spaces" (Smith, 2017).

As trusted spaces, libraries are able to engage people with health information, as well as being facilitators of access to it, thus addressing both the clinical and public health models of health literacy. The U.K. government's "Libraries Task Force" report Libraries Deliver: Ambition for Public Libraries in England 2016 to 2021 (2016) describes health and well-being as one of the seven outcomes that libraries can offer their communities. Their research shows that in the U.K. – a country that might be assumed to have relatively high levels of general and health literacy, at least on a global scale – 43 percent of working-age adults did not understand health information given to them (a figure that rose to 61 percent where this health information included statistics). The report argued that by offering access to both general information and health literacy training, often in conjunction with public health services, libraries were well placed to address this deficiency. Moreover, it also noted the importance of libraries as "non-clinical spaces in localities where health and well-being groups can work with the community in a trusted and non-threatening venue," a feature that has made libraries particularly important for supporting self-management of long-term medical conditions in people who might otherwise have little regular contact with health professionals. In Lithuania, the EIFL-funded Kaunas County Public Library BiblioHealth service works through a network of local libraries to provide internet access and digital literacy skills to older citizens, together with a range of programs including lectures, meditation, yoga, and exercise classes. The service recognizes that the benefits of better access to health information are likely to be greater in a group that is also engaged in community health and well-being activity (EIFL 2013a). The "Health Bridge" project created by the Lori Regional Library in Armenia includes an "e-health" service that combines digital and print resources, backed up by community training, public events and an online forum that enables users to talk with doctors (EIFL 2013b).

In other cases, the nature of the library as a "safe space" takes on more a more literal meaning. Writing in the Journal of the Indian Library Association, K. S. Raghavan (2016) argued that one reason why libraries are well placed to lead the country's digital information agenda is because libraries are "non-threatening environments where people, irrespective of age, gender and other factors, can feel free to have discussions and ask questions" – not a trivial issue in a country where issues of caste, religion and gender can place individuals at risk of violence. Rural Education and Development (READ) Global, which was founded in 1991 in Nepal, has created a network of 91 rural health libraries across Nepal, Bhutan, and India, serving a potential audience of 2.3 million people. READ centers provide health information resources on a range of subjects, including personal hygiene and sanitation, food and nutrition, disease prevention, and reproductive health. A critical factor in READ's success, highlighted by an evaluation report carried out in 2013, has been the provision of specialized services and "dedicated safe spaces for women to gather, share information, and learn from each other." This has led to benefits in terms not just of levels of information, but also the self-confidence to apply this knowledge, contributing to a self-reported 80 percent increase in the empowerment of female users and an increase of 68 percent in their decision-making power regarding family planning and health-care issues.

READ Global's network of rural health libraries in Nepal, Bhutan and India provided women with information and support, as well as a safe space to gather, share information and learn from each other. Participants recorded **major increases in their ability to take decisions on health issues**.

In health emergencies, libraries can go beyond being information distributors to become part of a two-way communication between those affected and those trying to help. In Nepal in the aftermath of the 2015 earthquake, the READ Global rural health libraries found themselves becoming hubs for medical care and shelter, and providing access to electricity for charging mobile devices as well as internet connections (READ Global, n.d.). When flooding affected more than 1.6 million people in Myanmar in the same year, libraries were at the forefront of providing support to those affected, building on digital services designed to help improve maternal and child health and providing an information conduit back to emergency relief organizations (Turner & Gebhart, 2015). Such activities are not restricted to lower-income countries. In 2012, for example, libraries in New Jersey and Connecticut in the eastern United States were able to provide safe community spaces and access to information for those forced from their homes or left without power or internet connections after a hurricane (Bayliss, 2012).

One consequence of a combination of improved access to health information and a strong sense of community engagement is the transition of libraries into active agents for health improvement. In Romania, staff at one county library were moved to action by comparative data released by Eurostat, the European Union's statistics agency. This showed that one in three people involved in serious accidents in Romania died as a result of inadequate first aid treatment. A "train the trainer" program backed by an online portal was established,

leading to 90 librarians across 86 sites becoming accredited trainers and more than 2,000 members of the public receiving first aid training. The Kyrgyz Libraries Information Consortium "No to TB!" project was similarly inspired by data that revealed the extent of the tuberculosis infection in Kyrgyzstan. Information centers were created in 190 libraries, 800 health campaign workers were trained, and workshops were held to equip them with the digital literacy and social media skills necessary for them to become effective and informed advocates for health promotion (Turner 2012).

Conclusion

Programs such as those in Romania and Kyrgyzstan go far beyond simple access to health information. Yet they illustrate the added value that comes from the work of libraries as active agents for achieving the Sustainable Development Goals. Can information make us better? Based on evidence from across the world, it can, but it is not enough for information simply to be available for it to have an impact on health. Instead, it depends on information being mobilized appropriately – the right kinds of information, engaging the right kinds of users, under conditions that allow it to be used appropriately and trusted accordingly. If we regard health and well-being as a fundamental human right, and securing healthy lives and promoting well-being for everyone, at every stage of life, as one of the key conditions for our future prosperity and sustainability, then attention must be paid to where, how, and by whom information is accessible. Correctly mobilized, information empowers us to make better decisions about our own health and the health of others, and creates the potential for research and innovation to transform health for all. It helps us set goals and hold ourselves and others to account for their delivery. Libraries play a crucial role in every part of this ecosystem as organizations that vouchsafe the quality of information and provide routes to ensure that access is open to all, and as community spaces that enable people to access information and share ideas safely.

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Chapter 5:

A2I for Gender Equality

How access to information empowers women and girls

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"Paradoxically, while women may be least likely to demand and receive access to information, they are perhaps most in need of it" (Neuman, 2016, 83).

Access to information is intrinsically linked to the realization of United Nations Sustainable Development Goal 5: Gender Equality and Empowerment of Women and Girls, and in turn contributes to the achievement of other SDGs. Access to information, as defined in this report, entails an enabling environment that allows individuals to access, use, and share information and further develop their capabilities to apply this information meaningfully in their everyday lives. The development of their capabilities is key to their equality and empowerment, the objective of Goal 5, while the overall focus of the SDGs is on empowering the poorest and hardest to reach. In terms of equality, empowerment, and access to information, girls and women in less developed countries are those who have the least and need the most. Girls' and women's increased access to information will not only contribute to their empowerment but will also have a beneficial impact on society as a whole.

Under the Millennium Development Goals, significant progress was made toward girls' and women's access to information, particularly through information and communication technology (ICT), which has the power the reach females nearly everywhere. The International Telecommunication Union has a goal of gender equality in internet users by 2020. Near equality toward this goal has been reached in most developed countries, particularly in northern Europe and North America, while the global internet user gender gap is actually increasing (growing from 11 percent in 2013 to 12 percent in 2016). Least Developed Countries have the largest gender gap at 31 percent, with Africa experiencing the biggest regional gap (23 percent, ITU, 2016b). Severe gender gaps remain in less developed countries, with differences in education and income as major contributing factors. Women in less developed countries also fall behind in ICT skills at all levels (ITU, 2016b).

Mobile phones have become increasingly the most accessible and ubiquitous sources of information and communication in the world today. In nearly every country for which data is available, fewer women than men own mobile phones. The gender gap in both mobile phone usage and ownership is largest for women in Least Developed Countries, which are also the least connected. The disparity is greatest in ownership, which has important implications for girls' and women's access to information as well as independence and autonomy, all measures of gender equality (ITU, 2016b).[1]

This chapter will look at the benefits of increased access to information for girls and women as well as the ways in which this access can benefit society as a whole. It will examine the numerous obstacles that females face in many realms in their quest for information. It will then provide examples of best practices in information provision for and utilization by girls and women, with particular emphasis on the multiple ways in which libraries in less developed countries are assisting gendered access to information. It concludes with recommendations to ensure the contribution of improved and increased access to information toward the achievement of United Nations Sustainable Development Goal 5: Achieve Gender Equality and the Empowerment of Women and Girls.

There is a **gender gap** in Internet access, as well as **mobile phone ownership** and digital skills. The Internet access gap is growing worldwide, and is highest in Africa.

5.1 Benefits of girls' and women's increased access to information

The benefits to girls and women of increased access to information are myriad and far-reaching on both individual and collective levels and in many realms – social, economic, and political. These include:

On the individual level

- Resources for themselves, their families, their work, and their communities
- Reduced isolation and increased self-esteem
- Information to carry out their productive, reproductive, and community roles
- Access to health information for themselves and their families
- Tools to conduct their businesses and to compete in the knowledge society of a digital world
- A voice in their lives, their communities, their governments, and the larger world that shares their issues and problems
- Self-development through pursuits of their own choice
- Increased personal freedom and development through utilization of their capabilities

500M women worldwide are **illiterate. 99%** of these live in developing countries.

At the societal level

- Overall economic and social development. There is a strong correlation between economic development and the exercise of women's rights, including the human right to information (Duflo, 2012).
- Decrease in poverty.
- Increased food security in less developed countries.
- Improved health and education, capacity building, and cultural transformation for women and their families (Terry & Gomez, 2011).
- Greater social and economic inclusivity.

In the 21st century, simply having access to information will not automatically lead to women's empowerment and equality with men. The most important part of information access has become the capability to use it. UNESCO's Global Media and Information Literacy (MIL) Assessment Framework (2015), emphasizes the need for multiple literacies: information, media, ICT, and digital. The MIL approach is very much in line with Amartya Sen's capability approach (1999) emphasizing the individual's need to exercise effective choice. Girls and women need the ability to make the effective choice to utilize those resources on their own behalf, despite socioeconomic, cultural and political constraints (Nussbaum, 2000).

5.2 Obstacles to girls' and women's access to information

In recent years, girls and women worldwide have made substantial progress toward increased access to information and achieved varying degrees of improvement to their desire, skills, and knowledge to utilize information. Yet they still face a wide range of obstacles that prevent their access and effective use. These barriers are most prevalent in the continued pervasiveness of sociocultural obstacles. Some are general to all forms of information seeking while others are specific to the access and use of ICTs. All these barriers have to be taken into account as girls and women seek to effectively utilize information.

5.2.1 Sociocultural obstacles

Perhaps the most widespread obstacles, most prevalent in but not limited to less developed countries, are social and cultural issues. These obstacles, often embedded in customary law, span a broad range from outright patriarchy to paternalism and gender stereotypes that limit girls' and women's access to and use of information. They appear at the societal level as well as in the family and can include physical violence against women and denial of the right to use technology, the prevention of women from leaving home without permission to seek information, families favoring the education of boys and giving boys preferential use of ICTs, and many other barriers. These obstacles are so numerous and with such variation between cultures that it is difficult to list them all.

Among some of the aspects of patriarchy and paternalism that affect girls' and women's access to information are male attitudes that women need their permission to leave the house to seek it. In Guatemala, Liberia, and Bangladesh, Neuman showed that the majority of men shared that belief and that women feared reprisal from both their families and authorities by seeking information. Women seeking information also suffered from negative attitudes of men in public office, leaving them afraid to ask for it (2016). The control also extended to women attending literacy classes. "The problem is like some men don't believe that the women are going to the seminars … they think they are going somewhere different" (Jones, 2009, 127).

5.2.2 Gender biases and stereotypes

Gender biases toward women studying or using information technology abound. Throughout the world, there are problems in attracting young women to science and technology studies. Often (predominantly male) math and science teachers, particularly but not exclusively in less developed countries, hold outmoded

views that girls can't think or work scientifically and that science is too mechanical and technical for girls, thus discouraging female students. Girls are frequently encouraged to take any job or get married rather than seek higher education.

Other gender stereotypes can get in the way of schoolgirls and information access. In Uganda, girls did not get access to the limited number of machines installed in school computer labs because of the sociocultural norm that "girls do not run." As a result, boys ran and got to the computers first and refused to give them up to girls. In addition, earlier curfew hours for girls at boarding schools further constrained their use (Gadio, 2001). Many girls and women either cannot use the internet or get the last opportunity to access it when it is available in the home, and girls are given less exposure to it than boys in school. In India in the well-known "hole in the wall" experiment, the aggressiveness of boys pushing away girls prevented the girls from using the computers (Mitra & Rana, 2001).

5.2.3 Negative attitudes about women and technology

In a training program on ICT basics for men and women from rural farming communities near Cajamarca, Peru, men mocked the women who undertook information technology training with men, saying that computers were for men, not women (Hafkin, 2002a). In Mankosi, South Africa, women were central to the establishment and operation of a community telecommunications network, but their contribution was not recognized because it was somehow considered part of their domestic duties (Hussen & Bidwell et al., 2016).

5.2.4 Control and violence

In recent years, increasing incidents have been reported of control and violence against women as a result of their use of mobile phones. Women informants in a Research ICT Africa study reported that their partners controlled and/or limited their telephone use. Domestic violence has resulted when men have become jealous or suspicious when their wives or girlfriends use or own mobile phones, when women monitor men's call logs, or when they answer their mobiles (Wakunuma, 2007; Gillwald, 2008).

5.2.5 Infrastructure and location

In virtually all of the less developed countries, information and communications infrastructure is weaker and less available in rural and poor urban areas, where women are the majority of residents. In many of the less developed countries, internet connectivity is frequently available and affordable only within capital and major secondary cities, while most women live outside these cities (UNIFEM and UNU/TECH, 2000).
Women's lesser access to information applies to the location of libraries, telecentres, and cell towers as well. Although this is changing with greater awareness, there are few brick-and-mortar libraries offering full services to women in rural areas of less developed countries.

5.2.6 Hours and availability

For both social and financial reasons, women's mobility is more limited than that of men. Women's multiple roles and domestic burdens afford them less time to utilize public access facilities. Information centers or cybercafés are frequently located in places that women may not be comfortable frequenting and open only when it is problematic for women to visit them and return safely to their homes. In general, libraries are more comfortable and offer better hours for women to visit.

5.2.7 Education and skills

Education: Lack of education clearly limits girls' and women's access to information. Two-thirds of the world's illiterates, numbering about 500 million, are female, and 99 percent of these are found in less developed countries, a share that has held steady since 1990 despite increasing rates of primary school education for girls. In Eastern and Western Asia, females make up nearly three-quarters of the illiterate population (United Nations, 2015).

Digital skills: Women in general have lower levels of digital skills than men, for a number of reasons that include technophobia. The Web Foundation reports that women are 1.6 times more likely than men to report lack of skills as a barrier to internet use (World Wide Web Foundation, 2015). These conclusions are generally accepted but difficult to document. Sex-disaggregated information on digital skills has been largely absent from international standard statistics, except for those of the more developed countries and economies, and has been very difficult to collect (UNCTAD, 2014).

Lack of content

Although efforts are underway to correct its absence, there remains little available content (printed and in ICT form) that meets the information needs of women in less developed countries, especially in languages that they read (for those who are literate). The content issue is closely related to that of language.

Language barriers

The major languages of information on the internet are English, Chinese, Spanish, Arabic, and Portuguese. Many women in less developed countries neither read nor speak these languages, and few information materials are available in topics of interest that meet the needs of women speaking and reading other languages. Character representation in also a problem: It may be difficult to access information if you read a language not written in Latin script, such as Amharic or Hindi.

These problems all pose limitations to girls' and women's access to information.

5.2.8 Financial obstacles

With libraries being the exception, most information and communication facilities cost money to use. Women are less likely than men to have the disposable income to do so, or hesitate to use family food, education, child-care and clothing resources for information. Comprising the largest percentage of those living in poverty, many women in less developed countries lack money for transport to access information, for public information fees, photocopying, books, and cellphone time. Women are also less likely than men to own radios and televisions, mobile phones, or computers, or to access them when they want to, in the case of household possession of the technology.

5.2.9 Policy constraints

The lack of gender awareness in information policy and projects also constrains girls' and women's access to information. Gender analysis of national policies is more often absent than present. In ICT policy, policymakers often lack knowledge of gender aspects of technical issues, on one hand, and, on the other, gender advocates are frequently unaware of information technology issues. The lack of attention to gender issues in ICT often arises from the attitude that technology is gender-neutral, and therefore people assume that the provision of the technology will benefit males and females equally. Numerous studies have shown that this is not the case, and that women do not benefit equitably from ICT and development projects without specific gender analysis and efforts (Hafkin, 2002b).

5.3 New obstacles and the need for information literacy

New challenges to access and effective use have emerged, underlining the necessity of increasing levels of information literacy. These affect both men and women, but the challenges are often greater for women because their past information isolation leaves them less equipped to deal with these challenges. Primary among the new challenges is the emergence of siloed alternate realities: the increasing appearance of "alternate facts" and "fake news" that requires all people to have higher levels of media and information literacy. Just as more and more females have gained access to information media and learned to use them, the bar to their effective use has been raised, as the beneficial use of information requires a higher level of capability in the 21st century.

Realization of media and information literacy is not widespread among women in less developed countries. Girls and women have made a dramatic uptake of mobile phones that are used mostly for voice and messaging rather than for accessing, understanding, using, and sharing information. Mobile phone usage has increased most dramatically in Africa, with women comprising the largest number of users in some countries. While women hawkers and vendors in South Africa made heavy use of mobile phones for communication on business matters, none used the phones to search for business-related information (Jiyane & Mostert, 2010). Schoolgirls in less developed countries are heavy mobile phone users, but few use them to access education-related information (Porter & Hampshire, 2015).

5.4 Libraries at the forefront

Having seen the possible benefits of increased access to information for girls and women, as well as the personal, family, communal, and societal benefits that could accrue from it, we can look at gender outreach and education efforts undertaken by libraries that are contributing to meeting this objective in less developed countries.

Research shows that libraries may be more successful than other information access sources in reaching girls and women. Libraries in less developed countries serve more females than telecentres and cybercafés (Say et al., 2013), and libraries in general have smaller differences in the gender distribution of users than other public access venues (Gomez, 2012). The key element in libraries' success appears to be their active outreach to girls and women and the assistance they render. Cybercafés that only offer access to technology have the fewest women users.

Libraries have a number of advantages over other information venues in providing access and promoting use among girls and women. Libraries maintain a wealth of information resources – books, periodicals, journals, and audio-visual materials (CDs, DVDs, etc.), as well as increasing availability of multiple forms of access to ICT. Internet access in libraries is generally free, and people can access books, documents, periodicals, and databases in-library or remotely through websites. Libraries often offer mobile services, bringing their materials to communities rather than requiring travel to a central location, and delivering information via specialized libraries, such as the WHO Blue Trunk Libraries for health information in remote areas (WHO, n.d.). Libraries are perceived as safe, reliable, and affordable, often with trained female staff that can help in places where it is not always appropriate for females to interact with males (Jones, 2009). Librarians serve as invaluable infomediaries to guide those with little experience in accessing information and/or using ICTs. They also frequently offer training in use of multiple varieties of information services, as well as other information activities, while other venues and media tend to specialize in one type of information and means of access.

There are many examples where libraries in less developed countries are doing an exemplary job for women's equality and empowerment through their information initiatives. They are notable for their outreach efforts to diverse groups of girls and women, the variety of materials and modes of access that they employ, and the provision of most all of their services without cost. The drawback to these advantages is that libraries are few and far between in the areas where girls and women need them most – in less developed countries and particularly in rural areas.

5.4.1 Proactive community libraries

Many community libraries around the world are examples of proactive libraries that openly recruit previously marginalized women and those with few information resources and serve their needs, resulting in measurable increases in their empowerment and equality with men in their community. A stellar example is the *infocentros* of Chile (Kleine, 2013).

The "Algun" (not its actual name) *Infocentro* in Araucanía province of Chile, 600 kilometers south of Santiago, is part of BiblioRedes, Chile's national network of some 400 library-based *infocentros*. The *infocentros* approach to capabilities and the development of freedom has had important implications for women's empowerment.

Infocentros offer free public non-commercial access to the internet. Special efforts are made to ensure gender balance among participants, encouraging men as well as women to use their services, since most of the users were women at first. While overall internet users became equally divided between men and women, 65 percent of those enrolled in the free information technology classes were women. By design, women, young adults, and the poor receive preferential access to all BiblioRedes services. The aim was to provide a safe, secure, and non-judgmental space for information gathering. People had the freedom to use the technology to do whatever they perceived as valuable. The service actively sought to extend the capabilities of less advantaged people, the majority of whom were women.

Infocentros are women-friendly, as opposed to cybercafés, where majority of users are male. Access is provided for wheelchairs and baby strollers. Female users can talk and help each other as well as get help from the (most often) female directors of the centers, in a way that they couldn't from and with men. The center becomes a meeting place for women where they use their social resources for information empowerment:

> Making use of their social resources, women were able to negotiate the changed social structure to achieve certain choices, and thus women were more able than men locked into the *machismo* cultural norms to make more use of ICTs (Kleine, p.124).

Chile's infocenters won the 2006 Stockholm Challenge Award for creating a network that delivered free digital literacy classes to 220,000, served 6 million internet users, and brought about the development of municipal websites with local content in 3,000 localities (Biblioteca Nacional de Chile, 2006).

Women are **1.6 times more** likely than men to see **lack of skills** as a barrier to Internet use.

5.5 Recommendations to achieve Goal 5

While there is increasing frequency of girls' and women's successful access to and use of information toward their empowerment and equality, the obstacles to achievement of Goal 5 continue to present challenges for perhaps the majority of women in less developed countries. The following recommendations are presented In order to overcome these obstacles and accelerate the achievement of SDG Goal 5.

Strengthen existing libraries and create new ones

Many public and community libraries in less developed countries deliver comprehensive and accessible library and information services, especially for girls and women. These libraries offer girls and women information opportunities that can help them improve their lives and those of their families, empower themselves, and advance gender equality. They provide safe places where women feel comfortable going to read, pursue learning, access computers and the internet, undertake technology training, and talk with other women. However, their numbers are insufficient to tackle the enormity of the need.
Libraries should follow the principles of serving first those who need the most but now have the least. Their outreach to girls and women should prioritize information initiatives that involve ICT access and training as well as critical thinking. They can be especially crucial in increasing food security by working with women farmers in less developed countries to increase their access and use of information for enhanced food production (Ikoja-Odongo, 2008).

Promote national gender-sensitive and aware information and ICT policies

Engendering information and ICT policies is an area of great importance, perhaps the most important in

Table 3: Gender Information Indicators in the SDGs

Gender information indicators	**Source**
Proportion of individuals who own a mobile telephone, by sex *	ITU
Female internet users as a percentage of population	ITU
Proportion of youth/adults with ICT skills, by type of skills and sex *	ITU
Gender Inequality Index	UNDP
Percentage of population in a given age group achieving at least a fixed level of proficiency in functional (a) literacy and (b) numeracy skills by sex, gender, wealth *	UNESCO
* Indicators with limited availability of gender-disaggregated data.	

securing the benefits of the information age for girls and women. If gender issues are not articulated in information policy, it is unlikely that girls and women will reap the benefits of the Knowledge Society. Explicit attention is needed to ensure consideration of gender in policy through a requirement for gender analysis in the elaboration, implementation, and evaluation of information policies.

Gather data required for informed policy

Informed policy must be based on good data. However, few of the less developed countries collect and publish sex-disaggregated data on information access and use (UNCTAD, 2014). The global community needs to support the collection of sex-disaggregated information data, in particular the following SDG indicators on information related to Goal 5. However, an adequate amount of gender-disaggregated data is only available for two of the five key gender information indicators selected to track progress toward the SDGs.

In line with the linkage of information to gender equality, the global collection of data on the United Nations Minimum Set of Gender Indicators (United Nations, 2016) should also be strongly supported. International comparative gender and development indexes including the Gender Inequality Index (UNDP, 2015), which is part of the UNDP Human Development Report, are excellent sources. The Gender Equality in the Knowledge Society national assessments attempt to identify and measure the multiple factors that impede or promote women in the Knowledge Society (WISAT, 2017).

Increase information resources

Create more relevant content: Creation of more relevant and appropriate content is needed, particularly local content in local languages, especially by women for women and in formats that women can understand. Topics can cover health, sexuality and reproduction, agriculture, income generation, and women's rights, as well as content that allows women access to full freedom of choice and development of their capabilities. Written and audio-visual materials available in libraries and community centers as well as web-based materials are important in this regard.

Support development of mobile education: Libraries need to be involved in use of mobile phones for education and information, especially to supplement education of girls in schools and provide education for those who have dropped out or are otherwise unable to attend school. Mobile phones have the potential to substantially expand learning opportunities, particularly outside of the formal education setting, but despite their widespread acquisition by girls in less developed countries, to date they have been used little for knowledge seeking. Libraries could help make mobile education and information materials easily available and encourage their utilization.

Promote Media and Information literacy (MIL) for girls and women

Higher-level information seeking and using skills: Besides learning, MIL includes development of critical thinking and interpretation capacities and promotes social inclusion and human rights. It involves training in higher information literacy – the ability to use and judge sources, distinguish between fact and "alternative facts" and real and "fake" news, and recognize scams, and the discernment to disregard conspiracy theories (BBC, 2017). MIL is of particular importance to girls and women to secure the benefits of full participation in the Knowledge Society. Training in this area should be promoted.

Higher-level digital skills: Facilitating women's access to and use of the internet is the first step to overcome the large digital gender gap in less developed

countries. To reach the ITU goal of gender equality in internet use, special attention is needed to bring the internet to girls and women and to ameliorate the digital skill gap, particularly for higher-level skills, that exists in nearly all countries.

Combat social and cultural obstacles to gender equality and women's empowerment

Information rights, information access, and knowledge are in a virtuous cycle with women's empowerment and gender equality. It takes a measure of women's empowerment and gender equality to ensure that women have equal access to information and education. At the same time, having access to information and education is a strong force in promoting women's empowerment and gender equality and lessening social and cultural obstacles. Women's increased access to information and education resources can have the structural effect of shifting social norms and stereotypes in a gender equitable direction (Seguino, 2007). The more information and education that girls and women obtain, the more they will achieve, and sociocultural barriers will fall. The relationship between gender equality and access to information is a complex chain of events that reinforce themselves in a feedback loop. Interestingly, the few countries with more women internet users than men proportionately are also those that lead the world in the Gender Parity Index (ITU, 2016b).

In the 1990s, much ICT4D literature saw computer-based internet as a silver bullet for women's empowerment; in the following decade, smartphones came to occupy the same territory. In the second decade of the 21st century, the view has become more ambiguous, given the numerous instances of misogyny that appear on the internet daily and the frequent instances of male control of female possession and ownership of mobile phones (Hafkin, 2012). Females need information resources to empower themselves effectively, and the global community needs to work to combat the social, cultural, political, and economic obstacles they face. These obstacles can be confronted by raising awareness at the international level, making women's right to information explicit in governance and human rights agendas, and supporting SDGs on gender equality and empowerment, especially through access to information.

Libraries, particularly in less developed countries, have an important role to play in women's empowerment in reaching out to disadvantaged women to increase their access to information through literacy (including information literacy) and ICT training and by providing materials in local languages.

With all these efforts, girls and women can be empowered with the same freedoms, choices, and opportunities as boys and men by the year 2030.

Infocentros in Chile aim to break out of the **macho culture found in Internet cafés**. They provide a friendly space, where women can talk and build social bonds.

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End Notes

[1] It is highly significant that mobile ownership by sex has been made an SDG indicator of gender equality, despite the fact that few countries yet have such data. In view of the evident correlation between gender equality and women's mobile ownership, the UN adopted the indicator in an effort to stimulate member states to its collection.

Chapter 6:

A2I for Sustainable Infrastructure

Access to information as a fundamental pillar for innovation, infrastructure, and industrialization

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Information is critical for ensuring healthy, sustainable and economically vibrant societies. It is an intangible good used by people, and increasingly by machines, to develop services and enhance knowledge and expertise, and is deeply woven into the fabric of sustainable development. This is true for all the United Nations Sustainable Development Goals (SDGs) including Goal 9, which focuses on building resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation.

Information is a unique type of resource. Unlike other resources that need renewal or diminish with use, the value of information increases with its consumption; the more widely it is shared, the greater its impact and the more extensive its potential benefits. This is the premise that underlies the many different, but related "open" movements now sweeping across the globe. Open government, open data, open science and open access are all parallel efforts that aim to make information and data more available in order to maximize its use and value.

In the case of open government, for instance, the huge volumes of information produced by governments are considered to be key resources for social and commercial activities. Providing citizens with access to government information not only ensures greater accountability and improved public engagement with governmental activities, it also contributes to a wide array of economic outcomes, allowing businesses to use the information to develop novel services. The GovLab, a research center based at New York University that studies the impact of government information, asserts that access to government information stimulates economic growth, opens up new sectors, and fosters innovation; in the process, this creates new jobs and new ways for citizens to prosper in the world (Verhulst & Young, 2016).

Open data stimulates economic growth, opens up new sectors, fosters innovation, and so creates jobs and improves lives.

There are numerous examples of the use of government information and data by businesses around the world. The whole weather forecasting industry, for instance, is built on openly available environmental data. Similarly, access to geospatial information has stimulated the development of a huge array of applications, such as the Canadian "Neighbourhood Finder" initiative, which helps people find the ideal neighborhood for their lifestyle, allowing users to choose from more than 50 criteria (house pricing, school quality, commute type, proximity of amenities, safety, etc.) and finding the five neighborhoods that match best in Canadian cities (Neighbourhood Finder, 2015). Each year, the GovLab publishes a list of companies in several countries that use federal government open data. The list contains 17 categories of businesses, such as health care, education, environment, energy, finance, and transportation, reflecting the wide variety of services that are using open government data (Open Data 500).

6.1 Exploiting the open content of the web

It is estimated that the volume of information and data doubles every two years (Marr, 2015). Data is generated by everything around us at all times; every digital process, sensor and mobile device, and social media exchange produces data (IBM, 2016). The exploitation of this so-called "big data" has become a huge driver of economic performance. Through a variety of techniques such as data analytics and text mining, large volumes of raw content drawn from thousands of documents and data are converted into structured overviews, helping to discover patterns and extract new knowledge. We already encounter this in numerous aspects of our daily lives. Take the now ubiquitous recommender systems attached to many online services. While not always completely on target (e.g. "I've just been to Barcelona, so stop showing me advertisements for hotels there!"), they are becoming more sophisticated. Recommender systems are built on data collected from different sources and use inference methods to identify related content that might be of interest to users. Good recommender systems, along with access to data, have become a necessity for the competitive advantage of many online businesses; so much so that Netflix even offered a $1 million prize for anyone who could help improve its recommendations by 10 percent (Netflix, 2009).

Likewise, we are also seeing the rise of content aggregation platforms that pull together and repackage content created elsewhere. Storify and Pinterest, for example, are both built on this model. But it's not just big tech companies that are doing this; small businesses can also leverage the open content of the web for new business opportunities. The U.S.-based startup company Edamam, for example, text mines web resources and has developed an extensive knowledge base about food and nutrition for its customers. There are millions of recipes on the web, and they are increasingly accompanied by nutritional data. Edamam uses digital technologies to extract information from these highly distributed resources and generates real-time nutritional analysis for its users. By also leveraging government nutrition information, the Edamam platform categorizes information by different attributes, such as nutrition information, allergies, cooking time, recipe complexity and so on, helping users make healthier food choices (Edamam mines web data, 2017). While it is hard to estimate the impact of big data on economic performance, the European Commission (and many countries) considers big data a key contributor to competitiveness, growth and jobs in the 21st century (European Commission, 2017).

High-quality, publicly available information can also be a significant factor in the success of small businesses and self-employed people, helping them to innovate and adopt more efficient practices. In 2006, the British Library opened a Business and IP Centre in London to provide specialized support for small businesses. The center offers users access to a comprehensive collection of databases and publications, plus a program of practical workshops, one-on-one advice sessions and inspiring talks. The center has been extraordinarily successful. Over the past decade, more than 500,000 people have used the service, including more than 60,000 visitors in 2016 (British Library 2016). Many other libraries are following suit, recognizing the potential advantages for small businesses in having access to information (British Library, 2016).

The Human Genome Project aimed for **openness**, with sequencing **data** released within 24 hours. It succeeded in its objective two years early.

6.2 Everyone stands to benefit from access to information

Agriculture, a huge and important sector in most economies, is also being revolutionized because of access to real-time data and information. A large number of farmers are subsistence farmers, with an estimated 2.5 billion people around the world managing 500 million smallholder farm households (Smallholders, Food Security and the Environment, 2013). According to the United Nations, small farming is poised to unleash a new and sustainable agricultural revolution that could profoundly improve the lives of billions of people, if we can enable the right conditions (Smallholders, Food Security and the Environment, 2013). Critical to this revolution is improving farmers' access to information. Indeed, information has been characterized as "the cornerstone to successful farming in the 21st century" (Weiss et al, 2000).

Farmers' information needs are wide-ranging and include up-to-date information about weather and market conditions, research on new farming techniques, transportation schedules, and knowledge of fertilizers and pest controls. The Plantwise Knowledge Bank is one of many platforms being developed to link farmers with the information they need. For example, the Knowledge Bank has developed a search tool that helps farmers identify pests. Funded and supported by governments around the world, the tool enables farmers to identify new pests, infestations and diseases based on their geographic location, crop, and the plant part that has been affected. The technology has now been adapted for use on smartphones, allowing a much larger number of small farmers to use it (Plantwise Knowledge Bank, 2017). As more applicable information and data become available, the next challenge will be to connect farmers to the information in a way that it can be most usefully exploited.

6.3 Opening science for innovation: The Human Genome Project

In the research sector, the open science movement involves the removal of financial barriers to accessing academic publications, data and other products of research so they can be widely read and used by everyone in society: researchers, businesses, professionals, policymakers and citizens. The OECD (2016) calls open science the "next frontier" in scientific communication, and we are seeing widespread adoption of open science policies and practices by the research community around the world.

The Human Genome Project (HGP) is often held up as the model for open science, paving the way for a new culture of sharing and fundamentally altering the way we think about how to maximize the value of research beyond the scientific community. The $3 billion project to work at the international level to sequence the human genome project was launched in 1990 (Human genomes, public and private, 2001). At that time, genomics scientists had been largely working behind closed doors, sharing their results through scientific articles only after significant time lags. However, the HGP partners quickly realized that if they shared their results more promptly, they could make much faster progress, avoid unnecessary duplication, and maximize the usefulness of the data. In a groundbreaking agreement, the organizations participating in the project committed to sharing their data publicly within a six-month period, and by 1996, significantly strengthened this policy to make all new sequencing data publicly available within 24 hours. By 2003 and two years ahead of schedule, they had deciphered all 30,000 genes in the human genome. Not only did public data sharing help to greatly accelerate the advancement of our scientific understanding of genomics, but it also had huge economic benefits. Although some in the community had argued that public sharing of the genomics data would be detrimental and restrict industry's ability to commercialize and develop products, this was not actually the case. On the contrary, widespread access to the genomics data democratized and broadened the economic impacts of the project. Small and large companies alike were able to capitalize on the data in order to develop drug treatments and many other medical interventions. The Human Genome Project fundamentally changed the thinking around how to manage research outputs, and demonstrated that immediate public access to information can be the best way to ensure our investments are fully utilized.

Open science is now spreading across the entire academic community, with the adoption of open science policies and practices across countries and disciplines around the world.

Access alone is not everything – people need the skills to manage it, assimilate it and understand it.

6.4 Information is becoming the foundation for efficient infrastructure

Information also plays an increasingly important role in developing resilient and efficient infrastructures. Smart cities are a great example of how digital information can be used to improve public infrastructure and services. Smart cities gather data from devices and sensors embedded in roadways, power grids, buildings, mobile phones, and other locations. The data is then made available as the basis for digitally enhanced services supporting the development of quality, reliable, sustainable and resilient infrastructure to support economic development and human well-being (Smart Cities Council, 2013).

Santander, Spain, is known as the smartest smart city and a testing ground for new services built on open data. The city has been wired up with thousands of sensors, transforming it into a smart city laboratory. Santander's Open Data website enables organizations to build services using the data collected by the city through these sensors and other means. The services fall into six categories: transportation, demography, public sector, commerce, society and welfare, and urban planning and infrastructure. Practical applications include apps that provide real-time information about parking, bus arrivals and bike sharing availability. They also alert city workers when pails are full and when grass needs to be watered (Spain's Santander hailed as global pioneering 'smart city,' 2016). They have even developed a smartphone app, *SmartSantanderRA*, that includes information about 2,700 places in the city. The app provides real-time access to traffic and beach cameras, weather reports and forecasts, public bus information and bike-rental service, generating a unique ecosystem for citizens and visitors who walk around the city (SmartSantanderRA: Santander Augmented Reality Application, 2014).

Although smart cities are mostly associated with wealthy countries, smart technologies are also starting to be adopted in less developed countries, helping to support domestic technology development and research and innovation in those regions. Nairobi, Kenya, for example, will be one of the first African cities to adopt smart traffic technology. Traffic congestion has become a major issue for many cities around the world and ultimately results in the loss of productivity, wasted fuel, and negative health impacts from vehicle emissions,

not to mention the negative impact on quality of life as people spend an increasing amount of time in their cars. Nairobi is one of the world's most congested cities. Its road systems, which were built at a time when there were 350,000 people living there, are now being stretched to the limit to support a population of more than 3 million. This has resulted in huge traffic problems. To address this, Nairobi is installing new sensor-powered traffic lights that will use real-time data to assess traffic needs, changing lights when needed to ensure maximum efficiency of traffic flow (Smart Traffic in Kenya, 2017). Intelligent transport systems are also being adopted in many other less developed countries. Other countries such as India and Brazil are also starting to implement smart methods as a means to address their own unique infrastructure challenges (World Bank, 2015).

6.5 Embedding access to information into society

In 2015, UNESCO proclaimed September 28 as "International Day for the Universal Access to Information," in recognition that the universal right to information is essential for societies to function democratically and for the well-being of each individual (International day for universal access to information, 2016). The examples provided here help to illustrate the important role of information in creating knowledgeable citizens, improving research and innovation, ensuring greater accountability and developing more efficient infrastructure. For the local farmer who discovers new fertilizers to increase crop yield, for the municipal engineer who learns about new materials to strengthen roads and bridges, for the pharmaceutical business that mines large biomedical databases to develop new medicines, and for the city planner who analyzes data to improve public transportation – access to information is an essential element for efficiency, innovation and a strong economy.

In the digital environment, where it is so easy and (relatively) inexpensive to share information, the potential benefits are even greater. This is especially so for the less developed regions. Open science, for example, greatly boosts research capacity in all countries, but is especially valuable for scientists in less developed countries who often do not have funds to subscribe to the research literature in their field.

However, while the opportunities are enormous, there are still many challenges. People need the skills to manage information, including helping them to distinguish reliable information sources from those of dubious quality. They need access to the internet because most information is now digital; and they need to have it in a format that they can assimilate and understand. Moreover, there will be no slowdown in the explosion of information and data in the foreseeable future, presenting even greater potential benefits, but also exacerbating the issues of how to navigate and extract value from vast quantities of content.

Libraries are an essential part of the information ecosystem, and bridges across the information gap. With their mandate to acquire, preserve and give access to information, they are also essential to innovation.

To take full advantage of the benefits of information, we need to ensure that information is widely available. Moreover, inherent to the notion of sustainability is that we are contributing to the well-being of future generations. Sustainability implies a holistic approach to addressing problems that takes into account multiple dimensions including ecology, society and economics, recognizing that all of these dimensions must be considered together to find lasting prosperity. This means we need to foster the enabling conditions that will formalize and embed access to information into all sectors of society by implementing the appropriate policies, infrastructures, and capacity building activities. These components are central for ensuring the unimpeded flow and uptake of information over the long term.

Information intermediaries, such as libraries, are an important part of the information ecosystem and can help to address many of the challenges. Libraries bridge the information gap by offering services to everyone in their community. They provide universal and affordable access to the internet for underserved populations, and they teach people how to navigate and use information resources in an increasingly complex digital world. Libraries are also one of the few organizations with a mandate to preserve information over the long term. As we continue to advance the targets set out for the United Nations SDGs, we must remember that information is a fundamental pillar of sustainable development, and continue our efforts to firmly entrench their values and practices.

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The role of A2I in advancing the SDGs: *The road ahead*

This report set out to answer the following questions: Can access to information create more socially and economically inclusive societies? Given the unprecedented ability we have today to gather, use, create, and exchange information, how can we capitalize on the strengths of the information society to help combat poverty and inequality, make governments more transparent and accountable, improve gender equity, increase youth's social and economic participation, and promote civic life in our communities?

To answer these questions, we began by taking a rights-based approach to information and establishing the Development and Access to Information framework, based on our definition of access to information as "the rights and capacity to use, create, and share information in ways that are meaningful to each individual, community, or organization." We established a baseline of access-to-information indicators to track progress over the lifespan of the SDGs Agenda and examined the ways in which access to information and libraries are contributing to advancing the SDGs. In so doing, this report captures the multifaceted and interdependent dimensions of access, providing an opportunity to systematically examine the SDGs through the lens of access to information. It also provides a model for understanding the bidirectional relationship between achieving SDG targets and meaningful access to information – the gains go both ways. Access advances the SDGs, and achieving the SDGs advances access.

Through this approach, we emphasize that access to information alone does not suffice to guarantee a truly inclusive society. The rights all taken together – economic, social, political, and civil – have an amplifying effect on each other. The rights are indivisible and inalienable. For example, strong infrastructure will only be fully utilized if legal frameworks are in place to establish and promote open access to government data and information. Further, internet access for women is only one factor in achieving gender equality. Understanding the role of access to information in development requires a multifaceted approach to measuring progress. We need to measure and track not only infrastructure indicators, but also those of inequality, freedom, and the capability to use information and communication technologies in meaningful ways. By establishing a baseline as this report does, limited as it may be, we can and will continue to measure these interconnected indicators to track progress.

While this report makes clear that affordability remains a significant challenge, simply making technology and connectivity cheaper will not ensure access to information for all. The challenges run deep, and are rooted in social and economic inequalities that surface as obstacles to basic connectivity, digital literacy, and technology affordability. These challenges must be overcome in order to ensure meaningful access to information and advance the SDGs. By providing free access to information, knowledge, and technology, libraries are exceptionally well-suited to help combat inequality. Libraries are usually safe physical places where people – regardless of gender, sexuality, income, race, or religion – can come to access information of all kinds. Through digital and information literacy and skill development programs, libraries encourage not only access to and consumption of information and knowledge, but creation and production of information and knowledge as well. When more people participate in creating and sharing information, our collective and individual knowledge grows and deepens. Further, many libraries around the world are going beyond just providing access to information and a physical space. As demonstrated in this report, there are a myriad of examples of libraries actively developing and hosting programs and services specific to meeting the SDGs.

As the chapters in this report show, there is huge potential for access to information to have a transformational role in advancing gender equality, sustainable agriculture, better health, and resilient infrastructure. This is not only the case in less-developed economies – the role access to information can play in every facet of development is critical for all countries and regions, regardless of their GDP. Of course, the needs of each country may differ depending on income levels, but as detailed in this report, there are threats to access to information – such as restrictions on freedom on the internet – in every country, across the income spectrum. Along with other social, political, and civil rights, access to information increases the likelihood of building equitable and just societies. By realizing how access to information can contribute to the SDGs and incorporating the right to access to information in development plans, services, and programs,

governments and policymakers at all levels and in all countries can make further progress toward meeting these goals.

The road ahead for development and access to information is a not a straight or easy one, but there is a clear path forward: Continue to track progress of the indicators for which this report establishes a baseline; invest in libraries as partners for reaching development goals; and, at the government level, embrace the inalienable right of access to information and include it in policy, programs, and services. As we travel down this path, we will be able to more accurately say not if access to information can play a role in development, but how large a role it plays.

Appendix 1: **Research Process**

The research process was composed of two main activities: establishing an indicator baseline and conducting stakeholder consultations.

A. Establishing an indicator baseline

Three steps were taken to select the collection of indicators used to create an indicator baseline. Researchers (1) reviewed the universe of indicators on development, access to information, and libraries (see list of sources below); (2) established codes, criteria, and ordinal scores; and (3) assigned codes and applied criteria to selected indicators.

1. *Reviewed universe of indicators.* Researchers scanned databases and reports from more than 30 international organizations, NGOs, and private sources, resulting in a list of nearly 1,000 indicators of interest. That list was reduced to the 300 indicators that aligned more closely within the four dimensions of the DA2I framework. We reviewed the methodology used for all selected indicators.

2. *Established codes, criteria, and ordinal scores.* Codes were chosen to reflect the nature of data available for each indicator: collection frequency, data collection method, geographic coverage of data, data granularity, extent of public availability, and theme. Criteria were then assigned to prioritize indicators based on these characteristics, as well as other characteristics related to project objectives. Criteria included:

    - Relevance: The indicator provides useful information on the state of A2I or libraries and can help guide the decisions of key decision-makers. Or, for a "library" themed indicator, it is relevant to an SDG target.

    - Directness: The indicator directly supports an SDG target.

    - Validity: The indicator is constructed from reputable/established data sources that are of known quality and adequately documented.

    - Reach: Data are collected is most countries.

    - Comparability: Data are currently collected, have been collected at least once before, and are expected to be collected into the future.

    - Availability: Data are available (open) and cost-effective (free or relatively inexpensive).
        - (Optional) Disaggregation: An indicator is disaggregated by sex, age, residence (urban/rural), and other characteristics, as relevant and possible.

    From the criteria, an ordinal scale of 1-3 (e.g., high to low, free to expensive) was constructed for each criterion, allowing the indicators to be scored and ranked.

3. *Assigned codes and applied criteria* to each of 300 indicators. The resulting scores and ranks were used inform the selection of indicators within each dimension of the DA2I framework.

The result of this process is shown in Appendix 3, Glossary of Indicators.

Additionally, this report references extremely valuable qualitative and quantitative data gathered from reports, white papers, and studies to contextualize baseline data. Such complementary data was excluded from the DA2I baseline, generally on the basis of medium to low criteria scores on the reach, comparability, or availability.

B. Consultations with stakeholders

The researchers conducted three rounds of meetings with leadership and staff from NGOs that work on issues related to information access, library support organizations, and the UNESCO Institute for Statistics. The meetings were used to solicit feedback on the strategy, baseline indicators, and analytical approach of the DA2I project, leading to the introduction of additional data sources and a revised analysis plan. Based on feedback obtained, the researchers reconsidered their plan to measure progress on individual SDG targets in relationship to access to information. They chose instead to investigate the contributions that access to information makes to development in a more integrated way, across the SDG agenda, by applying the DA2I conceptual framework.

C. List of sources consulted for indicator selection

- Access Info Europe and the Centre for Law and Democracy
- Alliance for Affordable Internet
- Bill & Melinda Gates Foundation Data Atlas (Global Libraries Common Impact Measurement System data)
- Carter Center
- European Bureau of Library, Information and Documentation Associations: Knowledge and Information Centre
- Environmental Democracy Index (convened by World Resources Institute)
- Eurostat Information Society
- Freedom House
- Gallup
- Global Forum on Migration and Development
- Google
- Indicator World Stats
- International Federation of Library Associations and Institutions
- International Labour Organization
- International Organization for Standardization
- International Telecommunication Union
- Netcraft
- Online Computer Library Center global library statistics
- Organization for Economic Cooperation and Development
- Office of the UN High Commissioner for Human Rights
- Pew Research Center
- Sustainable Development Goal 16 Data Initiative
- Union for Ethical Biotrade
- United Nations Statistics Division
- United States Agency for International Development
- Varieties of Democracy Index
- Web Index
- World Health Organization
- Wikipedia
- World Intellectual Property Organization
- World Bank
- World Economic Forum
- World Migration Institute
- Worldwide Governance Indicators
- World Summit on the Information Society

Appendix 2:
Data Curation, Processing, and Analysis Strategy

Using existing indicators for the baseline DA2I report and subsequent progress reports provides access to a vast amount of data on countries around the world, including economic and population data, and data on infrastructure and access to technology. The challenge is that when combining these indicators to build a more complete picture of the relationships between these dimensions, the variety of sources, data types, and collection strategies present some additional challenges beyond just the analysis. This section details the steps taken to compile the data, the processing done before any analysis, and finally the general data analysis strategy.

Data curation

To facilitate analysis and comparisons between the broad range of indicators selected for the baseline report, data for each indicator was compiled into a single database. This is an ongoing process that will continue for the life of the DA2I project, as new data becomes available. Indicator data was primarily sourced using databases from the International Telecommunication Union, World Bank, International Labour Organization, UN, UNESCO Institute of Statistics, Varieties of Democracy, and Freedom House. Although merging indicators from all these sources into a single database facilitated analysis and comparison between indicators from different official databases, multiple challenges to this approach were discovered during the process:

1. Different standards used for country names. To resolve this, country names as used by the World Back were chosen as the standard, and data from all other sources was checked against this list, and any disparities fixed. This means that data extracted from the combined database for analysis has a consistent set of country names for all indicators.

2. Indicators are not consistently available for all countries for all years. In some cases, older data is available for fewer countries, but for others, only one data point is available for each country and the year data was collected varies. To mitigate this, as many years as possible were included in the combined database, so that if data was not available for a particular year, the most recent observation could be used instead. This also maximizes the flexibility as more indicators are added.

3. Each online database exports data in a slightly different format, requiring individual attention to ensure accurate import into the combined database. However, data extracted from the combined database is already in a consistent format, separating the data collection/import stage from the analysis stage.

Solving these challenges during the initial data curation phase simplified all of the subsequent analysis, reducing the possibility of errors in accessing and using the data.

Data processing

Two consistent challenges in preparing data subsets for analysis were due to inconsistencies in both the geographical and the time components of the indicator data. Although the data curation stage helped to mitigate these challenges, extra preparation of some indicators was required for analysis.

First, some indicators are only available for a subset of countries. For example, Freedom on the Net currently covers 65 countries, while the percentage of individuals using the internet by gender is available for 84 countries. The analytical problems are amplified in cases when two such indicators are compared, since the overlap between them in terms of which countries are covered by both indicators can be much smaller than either one individually. This impacted the types of analysis, most often preventing regional, income group, and world averages since not enough data was available for reliable estimates. Instead, in these cases analysis focused on presenting the data at the country level.

Secondly, the time components often required extra processing work when selecting data for a particular comparison between indicators. This is caused by two main factors: One, several indicators do not have a full panel of countries for each year; and two, some indicators have only one data point per country, collected in a variety of years. In these cases, a straight match using country and year between two indicators may return very few results. In some cases, one indicator in a comparison had a full panel for each year, which allowed matching by both country and year, effectively solving the problem. In other cases, however, the closest matching year for each country had to be computed for the two indicators, to compile the best available data

for each comparison. Hopefully this challenge will be mitigated in the future as more data is collected, but it is likely to remain a problem at some level.

Data analysis strategy

In general, analysis proceeded from a global view, to views by income group (using the World Bank categories) and region (from the UN Sustainable Development Goals report classification), and finally down to a country level. Disaggregating by income group and region bridges the gap between global averages and individual countries, offering a useful lens through which to view the data. Since countries can have vastly different population sizes, indicators that measured normalized values (percentages or counts per 100 inhabitants) were weighted by country population in world, income group, and regional averages, in order to make aggregate values more representative.

UN Sustainable Development Goal Region List

Country	Region Classification
Armenia	Caucasus and Central Asia
Azerbaijan	Caucasus and Central Asia
Georgia	Caucasus and Central Asia
Kazakhstan	Caucasus and Central Asia
Kyrgyz Republic	Caucasus and Central Asia
Tajikistan	Caucasus and Central Asia
Turkmenistan	Caucasus and Central Asia
Uzbekistan	Caucasus and Central Asia
Albania	Developed regions
Andorra	Developed regions
Australia	Developed regions
Austria	Developed regions
Belarus	Developed regions
Belgium	Developed regions
Bermuda	Developed regions
Bosnia and Herzegovina	Developed regions
Bulgaria	Developed regions
Canada	Developed regions
Channel Islands	Developed regions
Croatia	Developed regions
Cyprus	Developed regions
Czech Republic	Developed regions
Denmark	Developed regions
Estonia	Developed regions
Faroe Islands	Developed regions
Finland	Developed regions
France	Developed regions
Germany	Developed regions
Greece	Developed regions
Greenland	Developed regions
Hungary	Developed regions
Iceland	Developed regions
Ireland	Developed regions
Isle of Man	Developed regions
Israel	Developed regions
Italy	Developed regions
Japan	Developed regions
Latvia	Developed regions
Liechtenstein	Developed regions
Lithuania	Developed regions
Luxembourg	Developed regions
Macedonia, FYR	Developed regions
Malta	Developed regions
Moldova	Developed regions
Monaco	Developed regions
Montenegro	Developed regions
Netherlands	Developed regions
New Zealand	Developed regions
Norway	Developed regions
Poland	Developed regions
Portugal	Developed regions
Romania	Developed regions
Russian Federation	Developed regions
San Marino	Developed regions
Serbia	Developed regions
Slovak Republic	Developed regions
Slovenia	Developed regions
Spain	Developed regions
Sweden	Developed regions
Switzerland	Developed regions
Ukraine	Developed regions
United Kingdom	Developed regions
United States	Developed regions
China	Eastern Asia
Hong Kong SAR, China	Eastern Asia
Korea, Dem. People's Rep.	Eastern Asia
Korea, Rep.	Eastern Asia
Macao SAR, China	Eastern Asia
Mongolia	Eastern Asia
Anguilla	Latin America and the Caribbean
Antigua and Barbuda	Latin America and the Caribbean
Argentina	Latin America and the Caribbean
Aruba	Latin America and the Caribbean
Bahamas, The	Latin America and the Caribbean
Barbados	Latin America and the Caribbean
Belize	Latin America and the Caribbean
Bolivia	Latin America and the Caribbean
Bonaire, Sint Eustatius and Saba	Latin America and the Caribbean
Brazil	Latin America and the Caribbean

British Virgin Islands	Latin America and the Caribbean
Cayman Islands	Latin America and the Caribbean
Chile	Latin America and the Caribbean
Colombia	Latin America and the Caribbean
Costa Rica	Latin America and the Caribbean
Cuba	Latin America and the Caribbean
Curaçao	Latin America and the Caribbean
Dominica	Latin America and the Caribbean
Dominican Republic	Latin America and the Caribbean
Ecuador	Latin America and the Caribbean
El Salvador	Latin America and the Caribbean
Falkland Islands (Malvinas)	Latin America and the Caribbean
French Guiana	Latin America and the Caribbean
Grenada	Latin America and the Caribbean
Guadeloupe	Latin America and the Caribbean
Guatemala	Latin America and the Caribbean
Guyana	Latin America and the Caribbean
Haiti	Latin America and the Caribbean
Honduras	Latin America and the Caribbean
Jamaica	Latin America and the Caribbean
Martinique	Latin America and the Caribbean
Mexico	Latin America and the Caribbean
Montserrat	Latin America and the Caribbean
Nicaragua	Latin America and the Caribbean
Panama	Latin America and the Caribbean
Paraguay	Latin America and the Caribbean
Peru	Latin America and the Caribbean
Puerto Rico	Latin America and the Caribbean
Sint Maarten (Dutch part)	Latin America and the Caribbean
St. Kitts and Nevis	Latin America and the Caribbean
St. Lucia	Latin America and the Caribbean
St. Vincent and the Grenadines	Latin America and the Caribbean
Suriname	Latin America and the Caribbean
Trinidad and Tobago	Latin America and the Caribbean
Turks and Caicos Islands	Latin America and the Caribbean
Uruguay	Latin America and the Caribbean
Venezuela, RB	Latin America and the Caribbean
Virgin Islands (U.S.)	Latin America and the Caribbean
Algeria	Northern Africa
Egypt, Arab Rep.	Northern Africa
Libya	Northern Africa
Morocco	Northern Africa
Tunisia	Northern Africa
Western Sahara	Northern Africa
American Samoa	Oceania
Cook Islands	Oceania
Fiji	Oceania
French Polynesia	Oceania
Guam	Oceania
Kiribati	Oceania
Marshall Islands	Oceania
Micronesia, Fed. Sts.	Oceania
Nauru	Oceania
New Caledonia	Oceania
Niue	Oceania
Northern Mariana Islands	Oceania
Palau	Oceania
Papua New Guinea	Oceania
Samoa	Oceania
Solomon Islands	Oceania
Tokelau	Oceania
Tonga	Oceania
Tuvalu	Oceania
Vanuatu	Oceania
Brunei Darussalam	South-eastern Asia
Cambodia	South-eastern Asia
Indonesia	South-eastern Asia
Lao PDR	South-eastern Asia
Malaysia	South-eastern Asia
Myanmar	South-eastern Asia
Philippines	South-eastern Asia
Singapore	South-eastern Asia
Thailand	South-eastern Asia
Timor-Leste	South-eastern Asia
Vietnam	South-eastern Asia
Afghanistan	Southern Asia
Bangladesh	Southern Asia
Bhutan	Southern Asia
India	Southern Asia
Iran, Islamic Rep.	Southern Asia
Maldives	Southern Asia
Nepal	Southern Asia
Pakistan	Southern Asia
Sri Lanka	Southern Asia
Angola	Sub-Saharan Africa
Benin	Sub-Saharan Africa
Botswana	Sub-Saharan Africa
Burkina Faso	Sub-Saharan Africa
Burundi	Sub-Saharan Africa
Côte d'Ivoire	Sub-Saharan Africa
Cabo Verde	Sub-Saharan Africa
Cameroon	Sub-Saharan Africa
Central African Republic	Sub-Saharan Africa
Chad	Sub-Saharan Africa
Comoros	Sub-Saharan Africa
Congo	Sub-Saharan Africa
Congo, Dem. Rep.	Sub-Saharan Africa
Djibouti	Sub-Saharan Africa
Equatorial Guinea	Sub-Saharan Africa
Eritrea	Sub-Saharan Africa
Ethiopia	Sub-Saharan Africa

Gabon	Sub-Saharan Africa
Gambia, The	Sub-Saharan Africa
Ghana	Sub-Saharan Africa
Guinea	Sub-Saharan Africa
Guinea-Bissau	Sub-Saharan Africa
Kenya	Sub-Saharan Africa
Lesotho	Sub-Saharan Africa
Liberia	Sub-Saharan Africa
Madagascar	Sub-Saharan Africa
Malawi	Sub-Saharan Africa
Mali	Sub-Saharan Africa
Mauritania	Sub-Saharan Africa
Mauritius	Sub-Saharan Africa
Mayotte	Sub-Saharan Africa
Mozambique	Sub-Saharan Africa
Namibia	Sub-Saharan Africa
Niger	Sub-Saharan Africa
Nigeria	Sub-Saharan Africa
Réunion	Sub-Saharan Africa
Rwanda	Sub-Saharan Africa
Sao Tome and Principe	Sub-Saharan Africa
Senegal	Sub-Saharan Africa
Seychelles	Sub-Saharan Africa
Sierra Leone	Sub-Saharan Africa
Somalia	Sub-Saharan Africa
South Africa	Sub-Saharan Africa
South Sudan	Sub-Saharan Africa
Sudan	Sub-Saharan Africa
Swaziland	Sub-Saharan Africa
Tanzania	Sub-Saharan Africa
Togo	Sub-Saharan Africa
Uganda	Sub-Saharan Africa
Zambia	Sub-Saharan Africa
Zimbabwe	Sub-Saharan Africa
Bahrain	Western Asia
Iraq	Western Asia
Jordan	Western Asia
Kuwait	Western Asia
Lebanon	Western Asia
Oman	Western Asia
Qatar	Western Asia
Saudi Arabia	Western Asia
State of Palestine	Western Asia
Syrian Arab Republic	Western Asia
Turkey	Western Asia
United Arab Emirates	Western Asia
Yemen, Rep.	Western Asia

Appendix 3:
Glossary of DA2I Indicators

Table 4: Indicators per DA2I dimension

DA2I Dimension	Indicators	Source(s)
Infrastructure	1. Population covered by at least a 3G mobile network, by type of network 2. Active mobile broadband subscriptions per 100 inhabitants. 3. Fixed broadband subscriptions per 100 inhabitants 4. Percentage of households with internet access 5. Percentage of households with a computer	ITU
Social context of adoption	1. Percentage of population living below national poverty line 2. Gender Inequality Index 3. Share of youth not in education, employment or training by gender	World Bank UNDP ILO
Capabilities of use	1. Percentage of internet users 2. Percentage of females using the internet 3. Individuals using the internet, by age and gender 4. Individuals with ICT skills, by type of skills by gender 5. Individuals using the internet by type of activity	ITU
Legal and policy environment	1. Civil liberties Index 2. Political Rights Index 3. Freedom on the Net 4. Freedom of Discussion	Freedom House Freedom House Freedom House Varieties of Democracy Index (V-Dem)

Access to infrastructure

Percentage of population covered by at least a 3G mobile network
The percent of total population that are covered by at least 3G mobile communication network. This indicator measures the percentage of inhabitants that are within range of at least 3G mobile cellular signal, irrespective of whether or not they are subscribers. This is calculated by dividing the number of inhabitants that are covered by at least 3G mobile cellular signal by the total population.

Active mobile-broadband subscription per 100 inhabitants
Active mobile broadband subscriptions are wireless-broadband Internet subscriptions using terrestrial mobile connections. Prepaid mobile-broadband plans require use in the last three months if there is no monthly subscription. Satellite and terrestrial fixed wireless broadband subscriptions are not included. The International Telecommunication Union (ITU) defines a bitrate of at least 256 kbit/s as broadband.

Fixed broadband subscriptions per 100 inhabitants
Total fixed (wired) broadband Internet subscriptions refers to subscriptions to high-speed access to the public Internet (a TCP/IP connection), at downstream speeds equal to, or greater than, 256 kbit/s. This can include for example cable modem, DSL, fibre-to-the-home/building and other fixed (wired) broadband subscriptions. This total is measured irrespective of the method of payment. It excludes subscriptions that have access to data communications (including the Internet) via mobile cellular networks. If countries use a different

definition of broadband, this should be indicated in a note. It should exclude technologies listed under wireless broadband category.

Percentage of households with Internet access
The Internet is a worldwide public computer network. It provides access to a number of communication services, including the World Wide Web, and carries e-mail, news, entertainment and data files, irrespective of the device used (not assumed to be only a computer; it may also be a mobile telephone, tablet, PDA, games machine, digital TV, and so on). Access can be via a fixed or mobile network. Household with Internet access means that the Internet is available for use by all members of the household at any time.4
Data are obtained by countries through national household surveys and are either provided directly to ITU by national statistical offices (NSOs) or obtained by ITU through its own research, for example from NSO websites. There are certain data limits to this indicator, insofar as estimates have to be calculated for many developing countries which do not yet collect ICT household statistics. Over time, as more data become available, the quality of the indicator will improve

Percentage of households with a computer
This indicator can include both estimates and survey data corresponding to the proportion of households with computer. A computer includes: a desktop; portable or handheld computer (e.g. a personal digital assistant). It does not include equipment with some embedded computing abilities such as mobile phones or TV sets. The proportion of households with a computer is calculated by dividing the number of in-scope households with a computer by the total number of in-scope households.

Percentage of individuals using the Internet
Individuals using the Internet refers to people who used the Internet from any location and for any purpose, irrespective of the device and network used in the last three months. It can be via a computer (i.e. desktop computer, laptop computer, tablet or similar handheld computer), mobile phone, games machine, digital TV, etc. Access can be via a fixed or mobile network.
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Affordability

Mobile broadband price (US$)
Price of the plan, in local currency, for a mobile-broadband handset-based prepaid tariffs with 500MB volume of data. (US$)

Use

Percentage of individuals using the Internet
Individuals using the Internet refers to people who used the Internet from any location and for any purpose, irrespective of the device and network used in the last three months. It can be via a computer (i.e. desktop computer, laptop computer, tablet or similar handheld computer), mobile phone, games machine, digital TV, etc. Access can be via a fixed or mobile network.
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Percentage of females using the internet
Share of female Internet users in the total number of females. This is calculated by dividing the number of female Internet users by the total number of females and multiplied by 100.

Individuals using the internet, by age and gender
This is the proportion of individuals who used the Internet from any location in the last three months, broken down by age and gender where possible.

Individuals with ICT skills, by type of skills by gender
This refers to ICT skills, defined for the purpose of this indicator as having undertaken certain computer-related activities in the last three months. Computer-related activities to measure ICT skills are as follows:

- Copying or moving a file or folder
- Using copy and paste tools to duplicate or move information within a document
- Sending e-mails with attached files (e.g. document, picture, video)
- Using basic arithmetic formulae in a spreadsheet
- Connecting and installing new devices (e.g. a modem, camera, printer)
- Finding, downloading, installing and configuring software
- Creating electronic presentations with presentation software (including text, images, sound, video or charts)
- Transferring files between a computer and other devices

- Writing a computer program using a specialized programming language

Source: ITU Manual for Measuring ICT Access and Use by Households and Individuals, 2014

Individuals using the internet by type of activity

This is the proportion of individuals who undertook one or more activities using the Internet for private (defined as non-work) purposes from any location in the last three months. Internet activities are defined as follows:

- Getting information about goods or services
- Seeking health information (on injury, disease, nutrition etc.).
- Making an appointment with a health practitioner via a website
- Getting information from general government organizations
- Interacting with general government organizations (downloading/requesting forms, completing/ lodging forms online, making online payments and purchasing from government organizations etc.) *General government organizations should be consistent with the SNA93 (2008 revision) concept of general government. According to the SNA "… the principal functions of government are to assume responsibility for the provision of goods and services to the community or to individual households and to finance their provision out of taxation or other incomes; to redistribute income and wealth by means of transfers; and to engage in non-market production." (General) government organizations include central, state and local government units.*
- Sending or receiving e-mail
- Telephoning over the Internet/VoIP (using Skype, iTalk, etc.; includes video calls via webcam)
- Participating in social networks (creating user profile, posting messages or other contributions to Facebook, Twitter etc.)
- Accessing chat sites, blogs, newsgroups or online discussions
- Purchasing or ordering goods or services (purchase orders placed via the Internet whether or not payment was made online; excludes orders that were cancelled or not completed; includes purchasing of products such as music, travel and accommodation via the Internet)
- Selling goods or services (via eBay, Mercado libre, Facebook etc.)
- Using services related to travel or travel-related accommodation
- Internet banking (includes electronic transactions with a bank for payment, transfers, etc. or for looking up account information; excludes electronic transactions via the Internet for other types of financial services such as share purchases, financial services and insurance)
- Doing a formal online course (in any subject)
- Consulting wikis (Wikipedia etc.), online encyclopaedias or other websites for formal learning purposes
- Listening to web radio (either paid or free of charge)
- Watching web television (either paid or free of charge)
- Streaming or downloading images, movies, videos or music; playing or downloading games (either paid or free of charge)
- Downloading software or applications (includes patches and upgrades, either paid or free of charge)
- Reading or downloading online newspapers or magazines, electronic books (includes accessing news websites, either paid or free of charge; includes subscriptions to online news services)
- Looking for a job or sending/submitting a job application (includes searching specific web sites for a job; sending/submitting an application online)
- Participating in professional networks (professional networks are also seen in the broader context of social networking and have the same requirement of profile creation, contributing through messaging or chat, or uploading text or audio-visual content files; examples of professional or business networks are LinkedIn and Xing)
- Managing personal/own homepage
- Uploading self/user-created content to a website to be shared (text, images, photos, videos, music, software, etc.)
- Blogging: maintaining or adding contents to a blog
- Posting opinions on civic or political issues via websites (blogs, social networks, etc.) that may be created by any individual or organization
- Taking part in online consultations or voting to define civic or political issues (urban planning, signing a petition etc.)

- Using storage space on the Internet to save documents, pictures, music, video or other files (e.g. Google Drive, Dropbox, Windows Skydrive, iCloud, Amazon Cloud Drive)

- Using software run over the Internet for editing text documents, spreadsheets or presentations

Source: ITU Manual for Measuring ICT Access and Use by Households and Individuals, 2014

Social context of ICT adoption and use

Gross National Income per Capita (Current International Dollars)
GNI is gross national income (GNI) converted to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GNI as a U.S. dollar has in the United States. GNI is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad. Data are in current international dollars based on the 2011 ICP round.

Percentage of the population living below the national poverty line
The proportion of the population below national poverty line measures poverty by the level of income/consumption available to an individual. A person is considered poor if his or her consumption or income level falls below some minimum level necessary to meet basic needs. This minimum level is usually called the "poverty line". What is necessary to satisfy basic needs varies across time and societies. Therefore, poverty lines vary in time and place, and each country uses lines which are appropriate to its level of development, societal norms and values.

Gender Inequality Index
The GII is an inequality index. It measures gender inequalities in three important aspects of human development: reproductive health, measured by maternal mortality ratio and adolescent birth rates; empowerment, measured by proportion of parliamentary seats occupied by females and proportion of adult females and males aged 25 years and older with at least some secondary education; and economic status, expressed as labour market participation and measured by labour force participation rate of female and male populations aged 15 years and older. The GII is built on the same framework as the IHDI â€" to better expose differences in the distribution of achievements between women and men. It measures the human development costs of gender inequality, thus the higher the GII value the more disparities between females and males and the more loss to human development.

Share of youth not in employment, education or training (NEET) by sex (%), ILO
The share of youth not in education, employment or training (also known as "the NEET rate") conveys the number of young persons not in education, employment or training as a percentage of the total youth population. It provides a measure of youth who are outside the educational system, not in training and not in employment, and thus serves as a broader measure of potential youth labour market entrants than youth unemployment, since it also includes young persons outside the labour force not in education or training. This indicator is also a better measure of the current universe of potential youth labour market entrants compared to the youth inactivity rate, as the latter includes those youth who are not in the labour force and are in education, and thus cannot be considered currently available for work.

Freedom

Freedom on the Net (Freedom House)
Freedom on the Net measures the subtle and not-so-subtle ways that governments and non-state actors around the world restrict our intrinsic rights online. Each country assessment includes a detailed narrative report and numerical score, based on methodology developed in consultation with international experts. This methodology includes three categories:

- **Obstacles to Access** details infrastructural and economic barriers to access, legal and ownership control over internet service providers , and independence of regulatory bodies;

- **Limits on Content** analyzes legal regulations on content, technical filtering and blocking of websites, self-censorship, the vibrancy/diversity of online news media, and the use of digital tools for civic mobilization;

- **Violations of User Rights** tackles surveillance, privacy, and repercussions for online speech and activities, such as imprisonment, extralegal harassment, or cyberattacks.

Freedom in the World (Political Rights Rating and Civil Liberties Rating), Freedom House
Freedom in the World is an annual global report on political rights and civil liberties, composed of numerical ratings and descriptive texts for each country and a select group of related and disputed territories. A country or territory is awarded 0 to 4 points for each of 10 political rights indicators and 15 civil liberties indicators, which take the form of questions; a score of 0 represents the smallest degree of freedom and 4 the greatest degree of freedom. The political rights questions are grouped into three subcategories: Electoral Process (3 questions), Political Pluralism and Participation (4), and Functioning of Government (3). The civil liberties

questions are grouped into four subcategories: Freedom of Expression and Belief (4 questions), Associational and Organizational Rights (3), Rule of Law (4), and Personal Autonomy and Individual Rights (4). The political rights section also contains two additional discretionary questions. (From https://freedomhouse.org/report/methodology-freedom-world-2017)

Freedom of Discussion, Varieties of Democracy
This indicator specifies the extent to which citizens are able to engage in private discussions, particularly on political issues, in private homes and public spaces (restaurants, public transportation, sports events, work etc.) without fear of harassment by other members of the polity or the public authorities. We are interested in restrictions by the government and its agents but also cultural restrictions or customary laws that are enforced by other members of the polity, sometimes in informal ways. (From V-Dem dataset codebook)

Glossary of Terms

A2I	Access to Information
DA2I	Development and Access to Information
EU	European Union
GII	Gender Inequality Index
GNI	Gross National Income
GODAN	Global Open Data for Agriculture and Nutrition
GPS	Global Positioning System
ICT	Information and Communication Technologies
IFLA	International Federation of Library Associations
ILO	International Labor Organization
ITU	International Telecommunications Union
NEET	(Youth) not in Education, Employment, or Training
NGOs	Non-governmental organizations
SDGs	Sustainable Development Goals
SMS	Short Message Service
TASCHA	Technology & Social Change Group
UN SDGs	United Nations Sustainable Development Goals
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
VPN	Virtual Private Network

Contributors Biographies

Thomas Baker
Dublin Core Metadata Initiative

Thomas Baker, since the 1990s an organizer of the Dublin Core Metadata Initiative, co-chaired the W3C working group that published Simple Knowledge Organization System in 2009 and currently works on Semantic Web projects such as the Global Agricultural Concept Scheme. He was a graduate exchange student at the Ecole Normale Supérieure in Paris, has a master's in library science from Rutgers University and a Ph.D. in anthropology from Stanford University. He has worked at the German National Research Center for Informatics, Fraunhofer, and the Goettingen State Library and has taught at the Asian Institute of Technology in Bangkok and Sungkyunkwan University in Seoul. Fluent in many languages, he promotes open Semantic Web vocabularies that are generically useful across multiple languages and disciplinary perspectives.

Simon Chaplin
Wellcome Trust

Simon Chaplin is the director of culture & society at the Wellcome Trust, a global charitable foundation dedicated to improving health for everyone by helping great ideas to thrive. As well as leading Wellcome's work on public engagement, education and humanities, and social science research, he is also executive sponsor of Wellcome's Open Research program. Before joining Wellcome's executive leadership team, he was head of the Wellcome Library, where he led a major digitization program, including materials from the European arm of the Medical Heritage Library, in partnership with the Internet Archive. He is a member of the Board of Directors of Research Libraries UK.

Michelle Fellows
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Michelle Fellows is a Research Analyst at the Technology & Social Change Group, where she uses mixed-methods research and program evaluation to answer questions related to information access, digital skill development, and how public libraries support community well-being. Fellows holds master's degrees in Public Administration and Library and Information Science from the University of Washington and a bachelor's in geography from the University of California, Berkeley.

Maria Garrido
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Maria Garrido is a Research Assistant Professor at the Technology & Social Change Group of the University of Washington's Information School. Experienced in conducting multi-country studies that span diverse geographic regions, much of her research focuses on the appropriation of information and communication technologies (ICTs) to catalyze social change, specifically in communities facing social, political, and economic challenges. Keenly interested in the role of ICTs in social movements, youth employability, and skill development, Maria has worked closely with civil society organizations, NGOs, public libraries, and development funders to conduct participatory research that results in actionable recommendations for policy and practice. Recent examples of her research include the role of Massive Open Online Courses (MOOCs) in advancing youth employability in Colombia, the Philippines, and South Africa; employability of migrant women and e-skills in the European Union; and youth movements, ICTs, and the struggle for democracy in Egypt's Arab Spring. Maria is currently leading a multi-year research effort focusing on the role of access to information in advancing the Sustainable Development Goals (SDGs).

Nancy J. Hafkin
Women in Global Science and Technology

Nancy Hafkin has been working to increase women's access to information for more than 40 years. Shortly after the first World Conference on Women, she joined the United Nations Economic Commission for Africa in Addis Ababa that housed the world's first regional women and development program. There, Hafkin served as chief of information and research and publications and set up a Women's Information Network in Africa. She went on to head the Pan African Development Information System at the UN Economic Commission for Africa and subsequently secured the establishment of the African Information Society Initiative. She has written widely on gender and Information in the developing

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Chris Jowaisis
Technology & Social Change Group, University of Washington

Chris Jowassis is a senior research scientist at the University of Washington Information School's Technology & Social Change Group. Previously, he was a senior program officer for the Global Libraries program at the Bill & Melinda Gates Foundation. Prior roles include grants management at the Texas State Library & Archives Commission and technology management at the Texas Library Association. Jowassis also served in multiple roles from 1997 to 2006 in the U.S. Library Program at the Gates Foundation. His research interests include optimizing data collection systems to focus on impact, and investigating how libraries reclaim and repurpose infrastructure for future

roles. He also still regales his three children with dreams of packing up the library gig and taking over the hot corner for the Cincinnati Reds. Jowassis holds an MLIS from the University of Michigan and B.A. from the University of Oklahoma.

Lucas Koepke
Technology & Social Change Group, University of Washington

Lucas Koepke is a data analyst for the Technology & Social Change Group, providing analytical, data processing, and statistical support for a variety of projects. Recent work includes data mining mobile phone logs, analysis of data on public access in Vietnam, and studying the use of MOOCs in developing countries. His research interests include big data, GPGPU computing, and data visualization. Koepke holds a Master of Science in Statistics from the University of Washington, and bachelor's degrees in Mathematics and Germanic Studies from the University of Colorado.

Ruthie Musker
Global Open Data for Agriculture and Nutrition

Ruthie Musker joined the Global Open Data for Agriculture and Nutrition initiative as its research and partnerships support officer to explore the impact of open data and knowledge sharing on food systems. She received a B.S. in Ecology, Behavior, and Evolution from the University of California, Los Angeles, and a M.S. in Conservation from University College London, and has done field projects in ecology and conservation in Mexico, Nicaragua, South Africa, Equatorial Guinea, and California. From her experience, she has seen how important sustainable agriculture systems are to environmental conservation. She has spent the past three years working in sustainable sourcing and food systems at the Agricultural Sustainability Institute at University of California, Davis, the Sustainable Agroecosystems Group at ETH Zurich, and the Rainforest Alliance.

Kathleen Shearer
Confederation of Open Access Repositories

Kathleen Shearer is the executive director of the Confederation of Open Access Repositories, an international association that is promoting a global network of open access repositories as the foundation for a more sustainable research communication system. Shearer graduated from McGill University in Canada with her master's degree in Library and Information Studies in 2003. She has been a longtime advocate for open access, digital repositories, and the role of libraries in scholarly communications. Shearer has also been a research associate with the Canadian Association of Research Libraries since early 2000 and was instrumental in the launch of the Portage Research Data Management Network in Canada. In addition, she is a partnership consultant with the U.S.-based Association of Research Libraries, providing expertise to the association about international activities, open access, and open data.

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