

2018

Information and Communications
for Development

Data-Driven Development



2018

Information and Communications for
Development

Data-Driven Development

Overview



WORLD BANK GROUP

This booklet contains the overview, as well as a list of contents, from *Information and Communications for Development 2018: Data-Driven Development*, doi: 10.1596/978-1-4648-1325-2. A PDF of the final, full-length book, once published, will be available at <https://openknowledge.worldbank.org/handle/10986/30437>, and print copies can be ordered at <http://Amazon.com>. Please use the final version of the book for citation, reproduction, and adaptation purposes.

© 2019 International Bank for Reconstruction and Development / The World Bank
1818 H Street NW, Washington DC 20433
Telephone: 202-473-1000; Internet: www.worldbank.org

Some rights reserved.

This work is a product of the staff of The World Bank with external contributions. The findings, interpretations, and conclusions expressed in this work do not necessarily reflect the views of The World Bank, its Board of Executive Directors, or the governments they represent. The World Bank does not guarantee the accuracy of the data included in this work. The boundaries, colors, denominations, and other information shown on any map in this work do not imply any judgment on the part of The World Bank concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

Nothing herein shall constitute or be considered to be a limitation upon or waiver of the privileges and immunities of The World Bank, all of which are specifically reserved.

Rights and Permissions



This work is available under the Creative Commons Attribution 3.0 IGO license (CC BY 3.0 IGO), <http://creativecommons.org/licenses/by/3.0/igo>. Under the Creative Commons Attribution license, you are free to copy, distribute, transmit, and adapt this work, including for commercial purposes, under the following conditions:

Attribution—Please cite the work as follows: World Bank. 2019. “Information and Communications for Development 2018: Data-Driven Development.” Overview booklet. Information and Communications for Development. World Bank, Washington, DC. License: Creative Commons Attribution CC BY 3.0 IGO.

Translations—If you create a translation of this work, please add the following disclaimer along with the attribution: *This translation was not created by The World Bank and should not be considered an official World Bank translation. The World Bank shall not be liable for any content or error in this translation.*

Adaptations—If you create an adaptation of this work, please add the following disclaimer along with the attribution: *This is an adaptation of an original work by The World Bank. Views and opinions expressed in the adaptation are the sole responsibility of the author or authors of the adaptation and are not endorsed by The World Bank.*

Third-party content—The World Bank does not necessarily own each component of the content contained within the work. The World Bank therefore does not warrant that the use of any third-party-owned individual component or part contained in the work will not infringe on the rights of those third parties. The risk of claims resulting from such infringement rests solely with you. If you wish to reuse a component of the work, it is your responsibility to determine whether permission is needed for that reuse and to obtain permission from the copyright owner. Examples of components can include, but are not limited to, tables, figures, or images.

All queries on rights and licenses should be addressed to World Bank Publications, The World Bank Group, 1818 H Street NW, Washington, DC 20433, USA; e-mail: pubrights@worldbank.org.

Cover image: Sam Smouha.
Cover design: Naylor Design.

Contents

<i>Contents of the Full Book</i>	<i>v</i>
<i>Foreword</i>	<i>ix</i>
<i>Acknowledgments</i>	<i>xi</i>
Executive Summary	1
Data deluge	1
Who benefits?	1
Data-driven business models	3
Data belongs to all of us	3
Notes	6
References	7
Annex: Data and affordability	7
<i>Contributors</i>	<i>13</i>
FIGURES	
ES.1 The growing internet	2
ES.2 Types of personal data	2
ES.3 The information and communications for development series	3
ES.4 Are you willing to share your data?	4
ES.5 Toward a new value chain for personal data	5
MAP	
ES.1 Data protection and privacy legislation worldwide, 2018	6



Contents of the Full Book

Foreword

Acknowledgments

Abbreviations

Executive Summary

Data deluge

Who benefits?

Data-driven business models

Data belongs to all of us

Notes

References

Chapter 1 Data: The Fuel of the Future

Data, data, everywhere

How data is changing development

A data typology

How governments use data

Structure of the report

Notes

References

Chapter 2 Supply: Data Connectivity and Capacity

The ever-expanding data universe

Goodbye data carriers, hello data creators

Cloud computing: Back to the future

Internet of Things: Data is all around

Data-driven business models

Data holes: Filling the gaps
Conclusions: Toward sustainable national data ecosystems
Notes
References

Chapter 3 **Better Data for Doing Good: Responsible Use of Big Data and Artificial Intelligence**

Introduction
The big data revolution
The evolution of artificial intelligence
Using big data and AI as a force for social good
From design to responsible use: Ethical challenges with using big data and AI
A way forward: Harnessing big data and AI to “leave no one behind”
Notes
References

Chapter 4 **People and Data**

Introduction
The data market
The benefits, costs, and risks for people
Remedies
Toward a more balanced data market
Looking to the future
Notes
References

Chapter 5 **Firms and Data**

Introduction
Digital platforms
Business models for digital platforms
Digital platform dynamics
Firms in the data economy
SMEs in the data economy
Looking ahead
Notes
References

Chapter 6 **Policies for the Data Economy**

Introduction
Policies for building data as an infrastructure asset
Data policies for building trust
Data security
Policies for maximizing the data economy
Notes
References

Data Notes **Data for Development Indicators**

Availability and users

Affordability and usage

Government

Infrastructure

Digital Adoption Index

Notes

References

Bibliography

Contributors



Foreword

It is my pleasure to introduce the 2018 edition in the series Information and Communications for Development, which in this fourth edition focuses on the opportunities and challenges of data-driven development. Since 2006, Information and Communications for Development has been a flagship report of a World Bank team that, this year, was elevated to a department in its own right and changed its name from Information and Communication Technologies to Digital Development. The changes reflect the World Bank's strong push to realize the potential of digital technologies to advance development, particularly in the poorest countries, and mark a shift toward a focus on the applications of technology, rather than technology per se, and from supply to client demand. These principles, introduced by the *2016 World Development Report: Digital Dividends*, guide the World Bank Group's investment and technical assistance in this area.

The theme of data-driven development fits well with this new focus. Data is all around us and can be invaluable once refined, processed, and analyzed. This report shows how governments in developing countries can enhance their use of data to provide better services to citizens. It also shows how the business sector is starting to capitalize on data for competitive advantage. For citizens, the report argues that new tools can allow them to take more control of personal data and benefit more directly from its value. For the World Bank Group and its development partners, the report contains plentiful examples of how big data and open data can be harnessed for better development outcomes.

But challenges loom. The growth of data platforms is changing the profile of competitive markets and business

models, away from subscriber-funded networks to advertising-funded services. This has important implications for how infrastructure is financed. In this evolving context, we must ensure that data is used for inclusion, not exclusion, and for enhanced privacy, not greater threats to security. The final chapter of the report looks at data policies for the digital economy and how conflicting demands can be reconciled. At a time when governments around the world are reviewing existing data policies and writing new ones, such as the European Union's General Data Protection Regulation, this report seeks to contribute to the debate.

As in previous years, this edition has been researched and drafted jointly with the World Bank's Finance, Competitiveness and Innovation Global Practice. It also benefits from contributions from the International Telecommunication Union and the United Nations Global Pulse, as well as inputs and review from other parts of the World Bank Group. We are likewise grateful for the support of the Digital Development Partnership and its donors, who made the report possible.

Smart use of data holds immense development potential that is already available to governments, businesses, and citizens. I am confident that this report will help these opportunities materialize to boost economic growth, reduce the digital divide, and bring better services and benefits to the people who need them most.

Boutheina Guermazi
Director, Digital Development Department
World Bank

Acknowledgments

This report was prepared by a team from the Digital Development Department (DDD) and the Finance, Competitiveness, and Innovation (FCI) Global Practice of the World Bank Group, supported by the International Telecommunication Union (ITU) and the UN Global Pulse team. The editorial team was led by Tim Kelly, under the guidance of Jane Treadwell (DDD), and comprised Siddhartha Raja and Carlo Rossotto (DDD), Prasanna Lal Das and Elena Gasol Ramos (FCI), Phillippa Biggs (ITU), Felicia Vacarelu (UN Global Pulse), and Andrew Stott and Michael Minges (independent consultants). The team was supported by Christine Howard and Roku Fukui (DDD) and David Hollander (UN Global Pulse). The work was funded by the Digital Development Partnership Trust Fund, whose members include the governments of Denmark, Finland, Japan, and the Republic of Korea as well as Microsoft and the Global System for Mobile Communications Association. Early work on the report also benefited from a contribution from the World Bank Group budget.

The principal authors by chapter are

- **Executive Summary:** Tim Kelly and Roku Fukui
- **Chapter 1, Overview:** Tim Kelly, Andrew Stott, and Michael Minges
- **Chapter 2, Data Supply:** Michael Minges and Tim Kelly
- **Chapter 3, Data for Good:** Phillippa Biggs (ITU) and Felicia Vacarelu, Miguel Luengo-Oroz, Mila Romanoff, and Robert Kirkpatrick (UN Global Pulse)
- **Chapter 4, Data and People:** Siddhartha Raja, Tatiana Nadyseva, Roku Fukui, and Rachel Firestone (DDD) and Michael Minges
- **Chapter 5, Data and Firms:** Carlo Rossotto, Mona Badran, and Tim Kelly (DDD), Elena Gasol Ramos, Eva Clemente Miranda, and Prasanna Lal Das (FCI), and Michael Minges
- **Chapter 6, Data Policies:** Elena Gasol Ramos, Eva Clemente Miranda, and Prasanna Lal Das (FCI)
- **Data Notes:** Michael Minges and Bradley Larson (East Asia and Pacific Global Practice)

Inputs, comments, guidance, and support at various stages of the report's preparation were received, and two formal review meetings were held. At the project concept note review meeting, held November 16, 2016, and chaired by Pierre Guislain (Senior Director, Transport and Digital Development), the peer reviewers were Randeep Sudan (DDD), Holly Krambeck (Transport), and Uwe Deichmann (*World Development Report 2016* Co-Director). Comments were also received from Roku Fukui, Anat Lewin, Siddhartha Raja, and Masatake Yamamichi (DDD) and Prasanna Lal and Jill Sawers (FCI). At the Decision Meeting of April 25, 2018, chaired by Jose Luis Irigoyen (Senior Director, Transport), the peer reviewers were Charles Hurpy and Casey Torgusson (DDD), Trevor Monroe (Global Themes—Knowledge), and Tariq Khokhar (Development Indicators and Data). Additional comments were received from Mark

Dutz, Mary Hallward-Driemeier, and Fredesvinda Montes Herraiz (FCI), as well as from the author team. Inputs were also received from Juan Navas-Sabater and Isabella Hayward (DDD).

Special thanks are owed to Patricia Katayama, of the the World Bank's Development Economics unit, and Michael Harrup, of the Bank's Editorial Production team, for oversight of the editorial production, design, printing, and

dissemination of the book. The maps, with the exception of Map B3.5.1 from the World Bank's India Lights Platform, were drawn by Bruno Bonansea (Creative Services). The team would also like to thank the many other individuals, firms, and organizations that have contributed through their continuing support and guidance to the work of the World Bank Group, particularly those focused on data for development.

Executive Summary

Data deluge

In a sample *second* in July 2018, it is estimated that some 2.7 million emails were sent and received, 74,860 YouTube videos watched, and 59,879 gigabytes of internet traffic carried.¹ Clearly, we generate huge and growing volumes of data.

The digital economy has become more information intensive, and even traditional industries, such as oil and gas or financial services, are becoming data driven. By 2020, forecasts Cisco (2017), global internet traffic will reach about 200 exabytes per month, or 127 times the volume of 2005, with much of the growth coming from video and smartphones (figure ES.1). And that data may hold huge value. McKinsey Global Institute (2016) estimates that cross-border data flows in 2014 were worth about US\$2.8 trillion, up 45-fold in value since 2005.

The vast majority of the data that exists today was created in just the past few years (IBM 2013). The challenge is to extract value from it and to put it to work—for firms, governments, and individuals. Every citizen is producing vast amounts of personal data that, under the right protective frameworks, can be of value for the public and private sectors. Firms are willing to pay ever-increasing amounts for our attention on social media sites and to mine the data we produce. But even data that is produced unintentionally—a byproduct of other processes, known as “data exhaust,” such as call data records or GPS coordinates—can have value when effectively analyzed.

Both types of data, their potential uses, and associated risks are all growing exponentially. Figure ES.2 shows common sources of personal data.

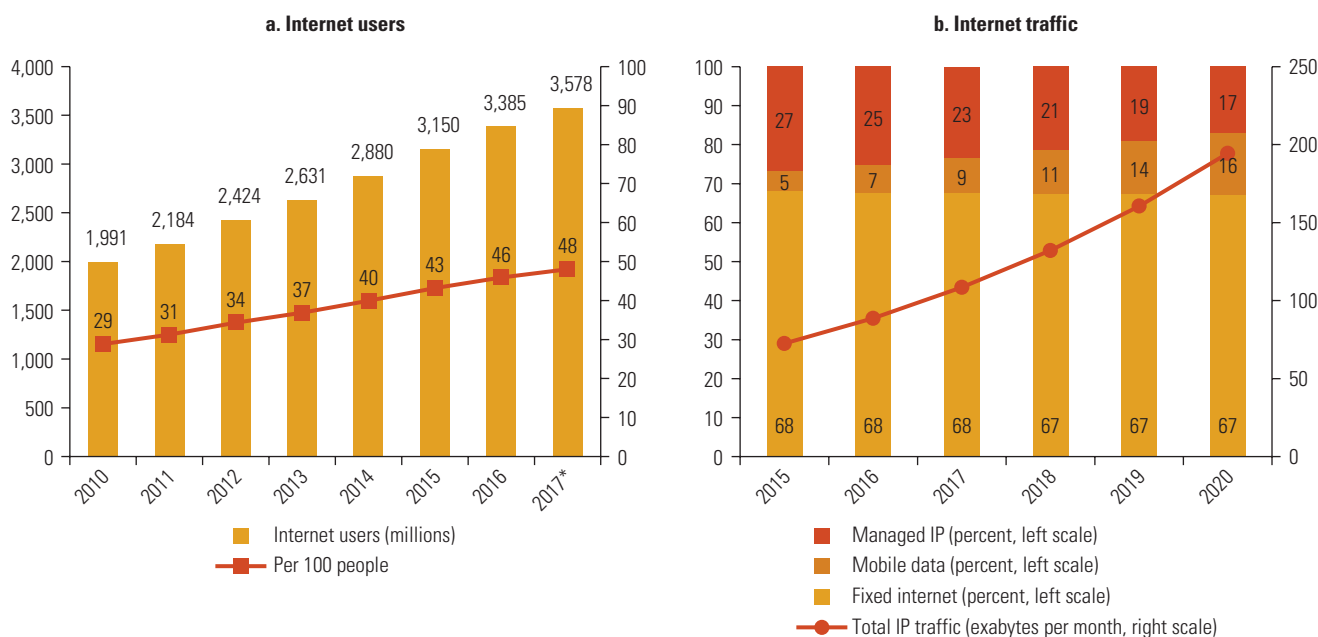
Who benefits?

This new report, the fourth in the Information and Communications for Development series (figure ES.3), examines data-driven development, or how better information makes for better policies. The report aims to help firms and governments in developing countries unlock the value in the data they hold to improve service delivery and decision making and empower individuals to take more control of their personal data. The report asks just how we can use this data deluge to generate better development outcomes.

People’s lives can benefit greatly when decisions are informed by relevant data that uncover hidden patterns, unexpected relationships, and market trends or reveal preferences. For example, tracking genes associated with certain types of cancer or explaining the potential links of Neanderthal DNA with resistance to the common flu virus or Type II diabetes can help improve treatments. As argued in chapter 3, development partners therefore need to establish strategies to better use data for development, while intervening appropriately in the data ecosystem and respecting data protection and privacy.

The World Bank Group, for instance, has established a Technology and Innovation Lab for improving data use

Figure ES.1 The growing internet

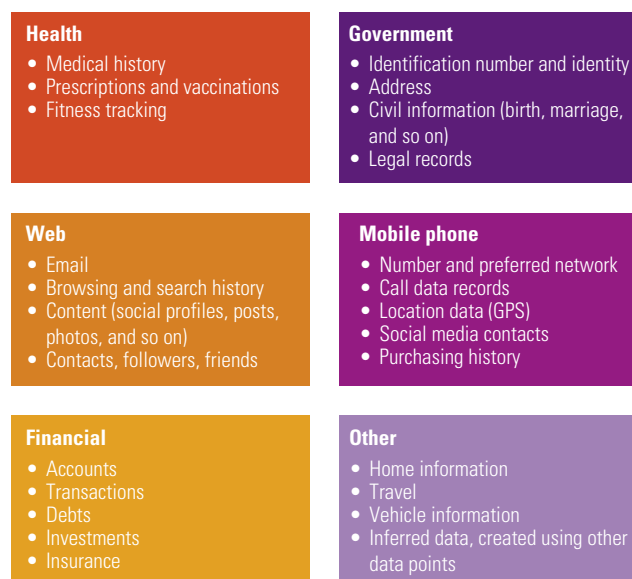


Sources: ITU (panel a); CISCO (panel b).

Note: An exabyte is one quintillion bytes (1 followed by 18 zeroes). Just five exabytes would be equivalent to all the words ever spoken by human beings (<http://highscalability.com/blog/2012/9/11/how-big-is-a-petabyte-exabyte-zettabyte-or-a-yottabyte.html>). IP = internet protocol.

* Data for 2017 is an estimate.

Figure ES.2 Types of personal data



in its projects, including using artificial intelligence and blockchain.² This is part of a broader work program that aims to leverage data and technology in its work.³ The International Telecommunication Union has so far hosted

two editions of the Artificial Intelligence for Good, Global Summit.⁴ And the team from UN Global Pulse, another partner in this report, is working with UN partners to responsibly harness big data and artificial intelligence for development and humanitarian action (see chapter 3).⁵

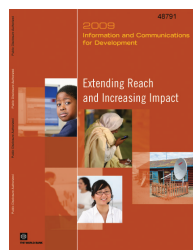
However, firms and organizations that can make the best use of the data are not necessarily the ones that collect it. An “open data” mind-set is critical to data-driven development. Thus, an open marketplace for data is to be encouraged within limits. It is important therefore to develop appropriate guidelines for data sharing and use, and for anonymizing personal data. Governments are already beginning to release value from the huge quantities of data they hold to enhance service delivery, though they still have far to go to catch up with the commercial giants. To use data intelligently for better development outcomes, national statistical offices will continue to play a core function, including that of objectivity and impartiality, producing data “without fear or favor.” But many statistics offices are struggling technically and financially. To remain relevant in an on-demand world, they need to strive for real-time data availability, striking an informed balance between accuracy and timeliness.

Figure ES.3 The information and communications for development series

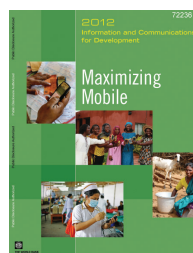
- **2006: Global Trends and Policies**



- **2009: Extending Reach and Increasing Impact**



- **2012: Maximizing Mobile**



Note: No Information and Communications for Development report was published in 2015, as this coincided with the *World Development Report: Digital Dividends*.

Data-driven business models

Companies are also developing new markets and making profits by analyzing data to better understand their customers. This is transforming conventional business models, as explored in chapter 2. For years, users paying for calls funded telecommunications. Now, advertisers paying for users' data and attention are funding the internet, social media, and other platforms, such as apps, reversing the value flow. The share of the value extracted by the network providers is shrinking, threatening future investment. Good business models for investment in telecommunication networks typically have high up-front sunk costs, but very long-term returns. Twenty to thirty years ago, companies that built networks—such as NTT, China Mobile, AT&T, or Deutsche Telekom—were the champions of their respective national stock markets. Their assets, like the infrastructure that they put in place, represent the backbone services operate on. But their market values have fallen in comparison to the businesses gathering and storing

data—such as Google and Alibaba Global—thanks to these existing infrastructures. Stock markets, in turn, assign huge potential to these data-rich companies, and undervalue the companies that keep the digital plumbing working.

We have seen this pattern before. In the early part of the nineteenth century, the markets of the time afforded optimistic valuations to the companies that built railroads. But as the century drew on, railroad investors went bankrupt or were nationalized because of their huge debts, even as the companies whose products they carried, such as mail-order companies, thrived in the early twentieth century.

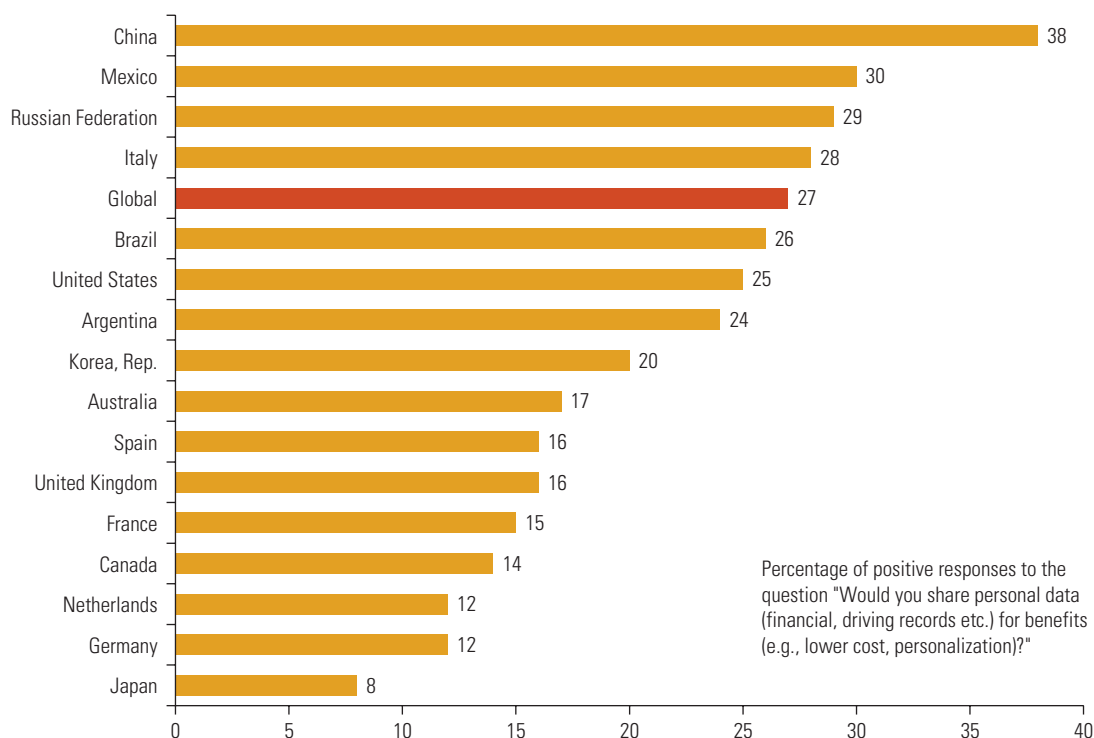
Once again, we face an inflection point. For more than a hundred years, infrastructure companies made their money primarily from subscriptions and usage charges paid by users—who paid by the minute, by the mile, and lately by the megabyte. This is changing. The value of telecommunication networks is now not so much in data transport as in data storage. As chapter 2 shows, the companies with the highest market valuations are those that collect then monetize their customers' data through targeted advertising. Services from Facebook, Google, or Tencent are largely “free” at the point of use—yet their bandwidth requirements grow ever larger, as does their customer reach.

Beyond internet business or commercial applications, multiple opportunities also exist for harnessing the value of big data and artificial intelligence to help us achieve shared development objectives, as exemplified in chapter 3. However, global efforts to develop new frameworks for the responsible use of emerging technologies must address their implications for society and the consequences of both using data and algorithms, and of failing to use them.

Data belongs to all of us

People need to exert greater control over the use of their personal data. Their willingness to share data in return for benefits (real or perceived) and free services, such as virtually unrestricted use of social media platforms, varies by country and by age group (figure ES.4). Consumer research from GfK, a German research institute, shows that willingness to share is highest in China and lowest in Japan. Early internet adopters, who grew up with the internet and are now age 30–40, are the most willing to share (GfK 2017). Many countries and regions have taken steps recently to update and reinforce rules on the use of personal data. The European Union's General Data Protection Regulation,

Figure ES.4 Are you willing to share your data?



Source: GfK 2017.

Note: Based on more than 22,000 consumers online in 17 countries with a response of 7 (on a scale from 1 to 7), where 7 represents full agreement.

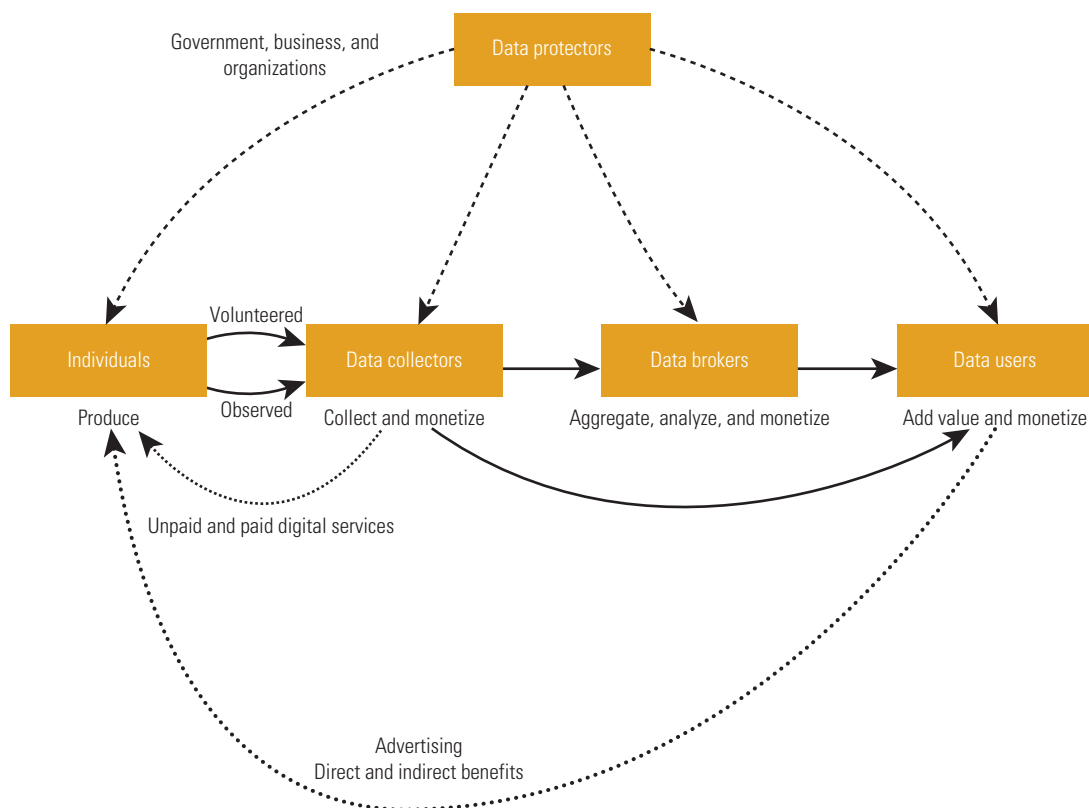
which went into effect on May 25, 2018, imposes a long list of requirements for companies processing personal data. Violations will result in fines that could total as much as 4 percent of global annual turnover.

Other countries have taken steps to restrict the flow of their citizens' data beyond their borders (data localization). In China, where data localization is strongly championed, restrictions on moving data are severe. Long-established controls over technology transfer and state surveillance of the population are predominant, and such measures form part of the country's "Made in China 2025" industrial strategy. The strategy is designed, in part, to make the country a global leader in tech-intensive sectors such as artificial intelligence and robotics. Chinese technology giants, including Baidu, Alibaba, and Tencent, are among the biggest in the world, and the country is establishing strong positions in new sectors like the Internet of Things (appliances, machines, and other items able to connect with the internet and exchange data). Throughout the world, data is regarded as a new asset class vital for industrial competitiveness.

Other emerging markets, such as India, Indonesia, the Russian Federation, and Vietnam, are also seeking data localization. The Russian Federation has blocked LinkedIn from operating in the country after the site refused to transfer data on Russian users to local servers. Divergent rules on the treatment of data impose significant costs on doing business online. Business organizations, including the International Chamber of Commerce, would like to establish rules to restrain what they call "digital protectionism."⁶ However, a serious gap exists in global governance with regard to cross-border trade in data, and a coherent approach is prevented by differing philosophies among the main trading blocs.

The ownership and control of data will continue to be a major question for society. Broadly speaking, there are three possible answers to the question "Who controls our data?": firms, governments, or users. No global consensus yet exists on the extent to which private firms that mine data about individuals should be free to use the data for profit and to improve services. Some governments argue that data from a country's citizens belongs to those citizens and should

Figure ES.5 Toward a new value chain for personal data



not leave the country without permission. Data dependency leads to new risks of exclusion. The data poor, who leave little or no digital trail because they have limited internet access, are most at risk of exclusion. But, equally, those who live in ways that society deems unconventional may also risk exclusion, for instance, because they lack a digital ID or are considered an insurance risk.

This report espouses the view that citizens should control their own data and should be free to choose how to release it and even to commercialize it (figure ES.5), as explored in chapter 4.

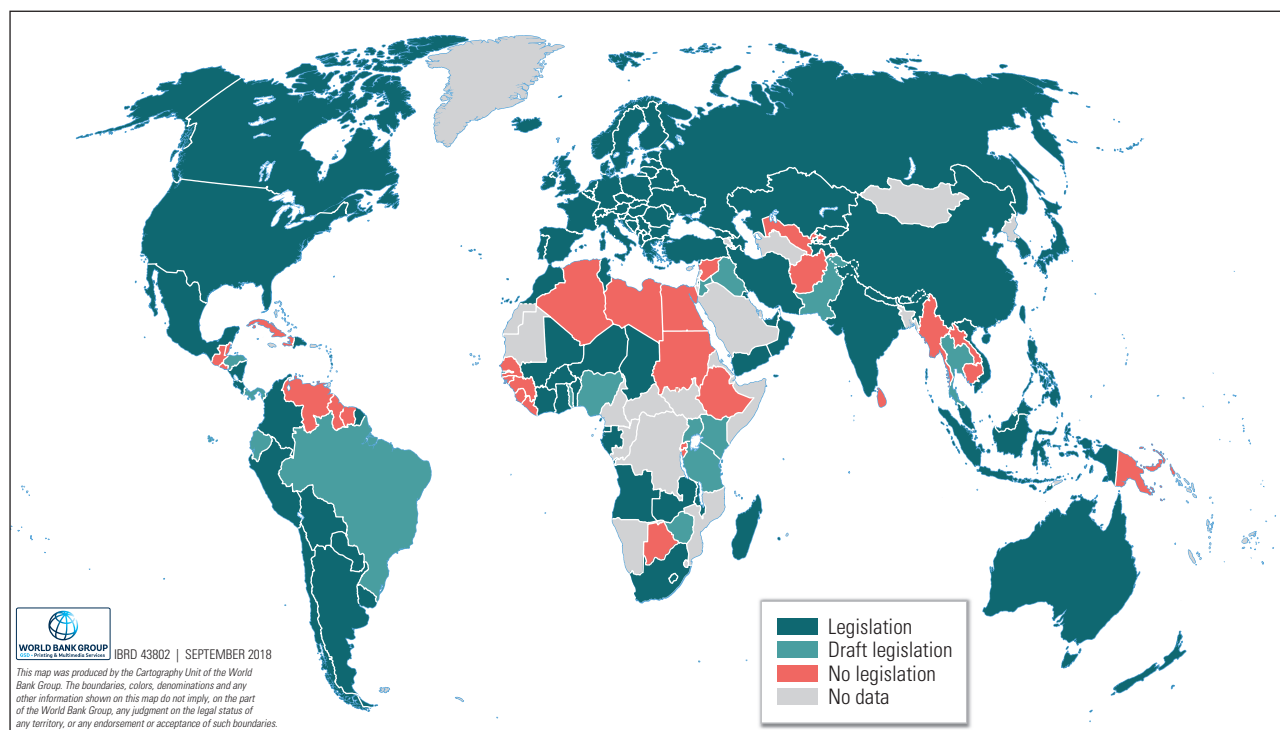
The growth of the data economy therefore requires changes in competition policy and the regulation of privacy. In a traditional, or one-sided, market, dominant firms are bad for overall market development. But when it comes to personal data, splitting the market share too many ways may inconvenience users and complicate matters for the individual if the different platforms do not connect, or if they require different passwords. As data becomes more important in shaping markets, it may reinforce tendencies toward monopoly, and thus monopoly profits, unless

competition rules are modified to deal with new concepts of dominance. The emergence of multisided platforms, explored in chapter 5, poses new challenges for regulators.

Data and the internet have predominantly been regarded by pioneers and campaigners as a decentralized, self-regulating community. Activists have tended to regard government intervention with suspicion, except for its role in protecting personal data, and many are wary of legislation to enable data flows. But that position is under pressure from the increasing centralization of the internet (Economist 2018) and a series of revenue data breaches and media exposés of questionable business practices by social media platforms. The use by political parties in Kenya, the United States, and elsewhere of data harvested from social media profiles does not appear to have broken any rules, but it has led politicians on both sides of the Atlantic to take a closer look at social media giants, such as Facebook and Twitter.⁷ The proliferation of “fake news” has also spurred calls for action.⁸

Data collected by governments, and thus paid for by taxpayers, arguably belongs to all of us. But there are limits to the openness paradigm. Citizens may not want data about

Map ES.1 Data protection and privacy legislation worldwide, 2018



Source: UNCTAD (http://unctad.org/en/Pages/DTL/STI_and_ICTs/ICT4D-Legislation/eCom-Data-Protection-Laws.aspx).

themselves to be exposed without protection. And governments often lack the resources to extract value from their data without private partners. Data-driven development needs greater dialogue between the custodians of a country's data and its users. The key to unleashing the power of data-driven development for developing countries lies in intelligent management, use, and supervision of data.

Chapter 6 reviews data-related policy issues relevant to the digital economy. It considers policies geared toward building consumer trust, policies that facilitate or can affect access to data, and the use of data as infrastructure. The chapter also covers mainstreaming policies, such as those that facilitate the use of data for innovation or those that build digital skills. At least 35 economies are currently drafting data protection laws (map ES.1). In addition, a number of economies are considering reforms to their legal frameworks. One factor driving this consideration is the European Union's adoption of the General Data Protection Regulation. While the regulation introduces, or confirms, many important principles for data protection and privacy, it also extends these principles to firms from other parts of the world that wish to do business in Europe.

Ironically, although data is becoming ever more important, data *about* data is still hard to find. The Data Notes to this report set out some of the indicators that should exist, and present data that do exist on an internationally comparable basis for indicators such as the price and affordability of data transmission and the availability of open government data.

This report aims to stimulate wider debate within the development community on the nature of data for development. It is not the first word on this topic and certainly will not be the last. But it is a topic of growing importance that cannot be ignored.

Notes

1. Internet Live Stats (Internetlivestats.com), one second of traffic on July 31, 2018.
2. Blockchain is technology that serves as a decentralized digital ledger that provides immutable record keeping. Applications are emerging in land registries, money remittances, biometric ID, and so on.
3. See <http://blogs.worldbank.org/taxonomy/term/15718> for information.

4. See <https://www.itu.int/en/ITU-T/AI/2018/Pages/default.aspx>.
5. For information see <https://www.unglobalpulse.org/pulse-labs>.
6. See <https://iccwbo.org/publication/trade-in-the-digital-economy/>.
7. See <https://www.theguardian.com/news/series/cambridge-analytica-files>.
8. See <https://www.digitaltrends.com/mobile/google-news-initiative/>.

References

CISCO. 2017. CISCO Visual Networking Index: Forecast and Methodology, 2016–2021. <https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/complete-white-paper-c11-481360.pdf>.

Economist, The. 2018. “How to Fix What Has Gone Wrong with the Internet.” Special report, June 28. <https://www.economist.com/special-report/2018/06/28/how-to-fix-what-has-gone-wrong-with-the-internet>.

GfK. 2017. “Willingness to Share Personal Data in Exchange for Benefits or Rewards.” https://www.gfk.com/fileadmin/user_upload/country_one_pager/NL/images/Global-GfK-onderzoek_-delen_van_persoonlijke_data.pdf.

International Business Machines Corporation (IBM). 2013. *Harness the Power of Big Data: The IBM Big Data Platform*. New York: McGraw-Hill.

McKinsey Global Institute. 2016. *Digital Globalization: The New Era of Global Flows*. New York. <https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/digital-globalization-the-new-era-of-global-flows>.

Annex: Data and affordability

Economy	Availability and users		Affordability and usage			
	Proportion of population covered by a 3G mobile network, 2015	Individuals using the Internet (% of population), 2016	Price of 1 Gigabyte (GB) of data (US dollars per month, 2016)	Price of 1 GB of data (% of GDP per capita per month, 2016)	GB per data user, 2016	GB per mobile subscription, 2016
Afghanistan	40	10.6	4.41	9.4	0.323	0.75
Albania	99	66.4	4.20	1.2		
Algeria	46	43.0	9.72	3.0	0.447	
Angola	100	13.0	19.99	7.7		
Antigua and Barbuda	98	73.0	25.92	2.2		
Argentina	90	71.0	15.78	1.5		0.51
Armenia	100	67.0	4.14	1.4		
Australia	99	88.2	22.82	0.5	1.543	
Austria	98	84.3	13.35	0.4	6.278	
Azerbaijan	97	78.2	2.91	0.9		
Bahamas, The	98	80.0	20.00	1.0		
Bahrain	98	98.0	15.79	0.8		
Bangladesh	71	18.3	2.94	2.6	0.322	0.14
Barbados	98	79.6	13.50	1.0		
Belarus	96	71.1	2.27	0.5		
Belgium	100	86.5	18.33	0.5	0.863	
Belize		44.6	15.00	3.7		
Benin	45	12.0	11.28	17.2	0.339	0.07
Bhutan	80	41.8	3.06	1.3		
Bolivia	27	39.7	7.42	2.9		
Bosnia and Herzegovina	96	54.7	6.72	1.7		
Botswana	92	39.4	28.15	5.0		

(continued next page)

Annex (continued)

Economy	Availability and users		Affordability and usage			
	Proportion of population covered by a 3G mobile network, 2015	Individuals using the Internet (% of population), 2016	Price of 1 Gigabyte (GB) of data (US dollars per month, 2016)	Price of 1 GB of data (% of GDP per capita per month, 2016)	GB per data user, 2016	GB per mobile subscription, 2016
Brazil	94	60.9	10.35	1.4	0.63	0.43
Brunei Darussalam	91	90.0	14.49	0.6		
Bulgaria	100	59.8	5.74	0.9		
Burkina Faso	10	14.0	8.05	14.9		
Burundi	0	5.2	5.45	22.9		
Cabo Verde	87	50.3	4.80	1.9		
Cambodia	70	32.4	2.00	1.9		3.00
Cameroon	50	25.0	6.43	7.5	0.249	0.08
Canada	99	89.8	41.35	1.2	1.57	1.225
Central African Republic	23	4.0	6.58	20.7		
Chad	13	5.0	16.45	29.7		
Chile	90	66.0	28.14	2.5		1.2
China	95	53.2	19.92	2.9		
Colombia	100	58.1	10.66	2.2		0.12
Comoros		7.9	8.68	13.4		
Congo, Dem. Rep.	20	6.2	13.00	34.7		
Congo, Rep.	50	8.1	16.45	12.9	0.192	0.06
Costa Rica	99	66.0	16.71	1.7		
Côte d'Ivoire	46	26.5	8.05	6.3	1.065	0.21
Croatia	99	72.7	7.55	0.7		
Cuba	0	38.8				
Cyprus	90	75.9	11.30	0.6	2.827	1.47
Czech Republic	99	76.5	31.74	2.1	0.983	
Denmark	100	97.0	23.14	0.5	4.373	
Djibouti	0	13.1	45.01			
Dominica	60	67.0	17.41	2.9		
Dominican Republic	99	61.3	8.68	1.6		
Ecuador	92	54.1	20.00	4.0		
Egypt, Arab Rep.	98	41.3	1.36	0.5		0.31
El Salvador	73	29.0	5.00	1.4		
Equatorial Guinea		23.8				
Eritrea	92	1.2				
Estonia	100	87.2	10.88	0.7	4.127	
Ethiopia	71	15.4	7.44	12.6		
Fiji	68	46.5	11.92	2.8		
Finland	100	87.7	22.80	0.6	10.948	
France	99	85.6	17.20	0.6	1.618	

(continued next page)

Annex (continued)

Economy	Availability and users		Affordability and usage			
	Proportion of population covered by a 3G mobile network, 2015	Individuals using the Internet (% of population), 2016	Price of 1 Gigabyte (GB) of data (US dollars per month, 2016)	Price of 1 GB of data (% of GDP per capita per month, 2016)	GB per data user, 2016	GB per mobile subscription, 2016
Gabon	97	48.1	8.79	1.5		
Gambia, The	86	18.5	6.55	16.6		
Georgia	99	58.0	1.99	0.6		
Germany	96	89.7	28.95	0.8	1.212	
Ghana	80	34.7	4.73	3.8	0.282	0.15
Greece	99	69.1	59.69	4.0	0.718	
Grenada	75	55.9	16.67	2.1		
Guatemala	92	34.5	13.26	3.8		
Guinea	39	9.8	3.30	7.8	0.157	0.07
Guinea-Bissau		3.8	58.29	112.8	0.054	0.02
Guyana	0	35.7	9.69	2.6		
Haiti	50	12.2	3.84	6.2		
Honduras	83	30.0	17.47	8.9		
Hong Kong SAR, China	99	87.5	6.16	0.2	1.477	1.602
Hungary	99	79.3	44.77	4.2	1.423	
Iceland	99	98.2	24.47	0.5	3.921	
India	74	29.6	3.77	2.7		0.88
Indonesia	60	25.4	4.10	1.4		
Iran, Islamic Rep.	60	53.2	3.91	0.9	1.112	0.6
Iraq	55	21.2	12.67	3.3		
Ireland	95	85.0	34.36	0.7	3.1	
Israel	99	79.7	21.85	0.7		
Italy	100	61.3	28.70	1.1	1.672	
Jamaica	90	45.0	15.31	3.8		
Japan	100	93.2	70.72	2.2	2.121	
Jordan	99	62.3	7.08	2.1		
Kazakhstan	73	74.6	4.48	0.7		
Kenya	69	26.0	4.98	4.1		
Kiribati	63	13.7	37.56	31.1		
Korea, Rep.	99	92.8	17.69	0.8	3.833	
Kosovo	91	82.9	5.65	1.8		
Kuwait	97	78.4	16.67	0.7		
Kyrgyz Republic	59	34.5	1.74	1.9		
Lao PDR	65	21.9	5.99	3.1		
Latvia	95	79.8	10.30	0.9	8.21	
Lebanon	97	76.1	19.00	2.9		
Lesotho	96	27.4	7.19	8.6		

(continued next page)

Annex (continued)

Economy	Availability and users		Affordability and usage			
	Proportion of population covered by a 3G mobile network, 2015	Individuals using the Internet (% of population), 2016	Price of 1 Gigabyte (GB) of data (US dollars per month, 2016)	Price of 1 GB of data (% of GDP per capita per month, 2016)	GB per data user, 2016	GB per mobile subscription, 2016
Liberia	50	7.3	5.00	13.2	0.178	0.06
Libya	50	20.3	10.80			
Lithuania	100	74.4	4.52	0.4	2.51	1.37
Luxembourg	99	98.1	22.91	0.3	2.912	
Macao SAR, China	100	81.6	12.00	0.2		
Macedonia, FYR	98	72.2	3.64	0.8		
Madagascar	61	4.7	4.67	14.0		
Malawi	32	9.6	5.36	21.4		
Malaysia	92	78.8	6.73	0.8	3.1	1.92
Maldives	100	59.1	12.95	1.8		
Mali	10	11.1	12.08	18.6	0.179	0.038
Malta	100	77.3	13.56	0.6		
Marshall Islands		29.8				
Mauritania	30	18.0	11.71	13.0		
Mauritius	93	52.2	8.62	1.1		
Mexico	89	59.5	11.59	1.7		0.27
Micronesia, Fed. Sts.		33.4	\$30.00	11.7%		
Moldova	99	71.0	2.70	1.7		
Mongolia	95	22.3	6.76	2.2		
Montenegro	97	69.9	22.93	4.1		
Morocco	80	58.3	4.99	2.1		
Mozambique	50	17.5	2.74	8.6		
Myanmar	79	25.1	2.14	2.0		
Namibia	37	31.0	13.42	3.9		
Nauru	98		22.30	3.4		
Nepal	50	19.7	2.80	4.6	0.177	0.07
Netherlands	99	90.4	30.58	0.8	1.024	
New Zealand	98	88.5	28.49	0.9	1.057	
Nicaragua	75	24.6	13.87	7.7		
Niger	10	4.3	6.58	21.7		
Nigeria	67	25.7	3.21	1.8	0.164	0.08
Norway	99	97.3	25.12	0.4	2.594	
Oman	95	69.9	13.16	1.1		
Pakistan	46	15.5	1.54	1.3	0.464	
Palau	88		49.90	4.4		
Panama	79	54.0	15.00	1.3		
Papua New Guinea	60	9.6	21.70	10.4		

(continued next page)

Annex (continued)

Economy	Availability and users		Affordability and usage			
	Proportion of population covered by a 3G mobile network, 2015	Individuals using the Internet (% of population), 2016	Price of 1 Gigabyte (GB) of data (US dollars per month, 2016)	Price of 1 GB of data (% of GDP per capita per month, 2016)	GB per data user, 2016	GB per mobile subscription, 2016
Paraguay	66	51.4	13.35	3.9		
Peru	91	45.5	17.87	3.6		0.42
Philippines	78	55.5	6.02	2.4		
Poland	100	73.3	10.52	1.0	3.548	
Portugal	99	70.4	34.93	2.1	1.521	
Qatar	98	94.3	16.48	0.3		
Romania	100	59.5	4.48	0.6		0.81
Russian Federation	73	73.1	6.86	0.9	2.315	1.43
Rwanda	88	20.0	4.91	8.4	0.271	0.12
Samoa	86	29.4	9.36	2.8		
São Tomé and Príncipe	2	28.0	8.84	6.0		
Saudi Arabia	97	73.8	29.33	1.8		
Senegal	40	25.7	3.06	3.8	0.709	0.198
Serbia	97	67.1	3.67	0.8		
Seychelles	90	56.5	18.33	1.5		
Sierra Leone	20	11.8	17.87	43.2		
Singapore	100	81.0	7.24	0.2		
Slovak Republic	93	80.5	32.41	2.4	0.66	
Slovenia	100	75.5	19.84	1.1	1.419	
Solomon Islands	12	11.0	25.16	15.1		
Somalia	30	1.9				
South Africa	98	54.0	10.75	2.5	0.44	0.26
South Sudan	20	6.7	133.70		0.084	0.02
Spain	99	80.6	38.75	1.8		
Sri Lanka	83	32.1	1.36	0.4	2.1	0.55
St. Kitts and Nevis	100	76.8	17.03	1.2		
St. Lucia	65	46.7	14.81	2.3		
St. Vincent and the Grenadines	100	55.6	14.81	2.5		
Sudan	46	28.0	4.64	2.3	0.361	0.19
Suriname	100	45.4	19.77	3.7		
Swaziland	21	28.6	32.70	14.1	0.16	0.09
Sweden	100	89.7	18.05	0.4	4.383	
Switzerland	100	89.1	31.40	0.5	2.712	
Syrian Arab Republic	70	31.9	8.12		0.165	0.06
Taiwan, China	100	86.3	6.55	0.3	7.4	
Tajikistan	60	20.5	1.52	2.3		
Tanzania	85	13.0	4.68	6.4		

(continued next page)

Annex (continued)

Economy	Availability and users		Affordability and usage			
	Proportion of population covered by a 3G mobile network, 2015	Individuals using the Internet (% of population), 2016	Price of 1 Gigabyte (GB) of data (US dollars per month, 2016)	Price of 1 GB of data (% of GDP per capita per month, 2016)	GB per data user, 2016	GB per mobile subscription, 2016
Thailand	97	47.5	5.57	1.1	3.9	
Timor-Leste	96	25.3	15.00	12.8		
Togo	50	11.3	8.23	17.1		
Tonga	70	40.0	10.83	3.5		
Trinidad and Tobago	75	73.3	22.34	1.7		
Tunisia	94	49.6	4.35	1.4		
Turkey	95	58.4	6.65	0.7	2.22	
Turkmenistan	60	18.0	14.29	2.7		
Tuvalu		46.0				
Uganda	60	21.9	8.43	16.4	0.144	0.05
Ukraine	35	52.5	2.82	1.5		
United Arab Emirates	100	90.6	27.25	0.9		
United Kingdom	100	94.8	21.91	0.7	1.839	
United States	100	76.2	46.62	1.0	2.665	
Uruguay	90	66.4	5.23	0.4		0.79
Uzbekistan	32	46.8	4.94	2.8		
Vanuatu	51	24.0	9.22	3.9	0.379	0.104
Venezuela, RB	90	60.0	1.05			0.35
Vietnam	70	46.5	1.78	1.0		
West Bank and Gaza	0	61.2				
Yemen, Rep.	80	24.6	11.61	14.1	0.103	0.02
Zambia	53	25.5	13.27	13.5	0.217	0.08
Zimbabwe	55	23.1	35.00	41.6		
East Asia and Pacific	82	51.6	16.34	4.2	2.8	1.7
Europe and Central Asia	92	75.2	16.18	1.3	2.9	1.3
Latin America and Caribbean	81	56.2	14.30	2.8	0.6	0.5
Middle East and North Africa	77	58.0	14.64	2.2	0.5	0.2
North America	99	88.0	43.99	1.1	2.1	1.2
South Asia	68	28.3	4.10	3.0	0.7	0.5
Sub-Saharan Africa	52	20.1	14.05	14.9	0.3	0.1
Low income	43	11.2	14.59	20.7	0.24	0.13
Lower middle income	65	33.6	9.46	5.4	0.44	0.38
Upper middle income	82	53.0	11.50	2.2	1.77	0.65
High income	96	82.5	23.63	1.1	2.91	1.28
World	77	51.7	14.98	5.5	1.82	0.51

Note: Data for groups is compiled using averages.

Contributors

Mona Badran (World Bank, Digital Development, consultant)—chapter 4

Associate Professor, Faculty of Economics and Political Science, Cairo University, Egypt

Mona is an economist with a main focus on digital economics, economics of telecommunications, and information and communication technology's role in development. She has extensive consulting experience working for numerous private sector clients and international organizations, such as the World Bank, International Telecommunication Union (ITU), GSMA, United Nations Economic and Social Commission for West Asia, and International Labour Organization. For more than five years, she advised the Egyptian Ministry of Investment, where she led the research department. Numerous times, she was awarded Cairo University's International Publications Award for publishing in Thomson Reuters-indexed journals in the area of Information and Communication Technologies for Development.

Phillippa Biggs (International Telecommunication Union)—chapter 3

Senior Policy Analyst, ITU

Phillippa has been an economist and qualified accountant with the International Telecommunication Union (ITU) since 2005. She holds a Natural Sciences degree from Cambridge University, an accountancy qualification

from the Institute of Chartered Accountants in England and Wales, and a master's in Economics for Development from Oxford University. Prior to joining the ITU, Phillippa worked as an Economic Affairs Officer at the United Nations Conference on Trade and Development and as a consultant with the United Nations Industrial Development Organization in Tanzania and Egypt. She is chief author of the *State of Broadband* report, *Confronting the Crisis* reports and *Fast-Forward Progress* report. She analyzes developments in broadband, voice over internet protocol, and 3G markets around the world.

Eva Clemente Miranda (World Bank, Finance Competitiveness and Innovation)—chapters 5 and 6

Eva, a Spanish national, started her journey at the World Bank Group in early 2012 when she joined the Digital Development Unit. As an Information and Communication Technology (ICT) Policy Specialist, she has assisted client countries in their efforts to harness the benefits of ICT-enabled innovation. As data has become an essential ingredient for innovation in today's digital economy, Eva's work has increasingly focused on supporting data policies and data-driven innovation and entrepreneurship in Latin America and Africa at the national and subnational levels. Currently, in the Finance, Competitiveness, and Innovation Global Practice, she promotes the digital economy agenda for Africa.

Elena Gasol Ramos (World Bank, Finance Competitiveness and Innovation)—chapters 5 and 6

Elena, a lawyer by training, is a Senior Private Sector Specialist with the World Bank, based in Washington, DC. She currently leads the Bank's engagement on digital economy, entrepreneurship, and innovation in Kenya and Burundi. She also provides advice to governments on data protection issues. Prior to this her work included a variety of positions within and outside the World Bank Group, in both Europe and the United States. Her areas of expertise include data protection and data security, consumer protection, and ICT policy and regulation. She is a member of both the Salamanca and New York bars and has taught comparative privacy law, with a focus on e-privacy, at the Georgetown University Law Center. She has a master's in European Law from the College of Europe in Bruges, Belgium, and an LLM from Georgetown University Law Center.

Rachel Firestone (Hala Systems—formerly World Bank, Digital Development)—chapter 4

Rachel is the Director of Operations at Hala Systems, a social enterprise that uses advanced technologies to save lives in conflict zones, to combat disinformation, and to bring accountability for war crimes. She specializes in information and communication technology (ICT) and sustainable development for communities in conflict and spent several years with the World Bank working on projects in Somalia and the Horn of Africa. Prior to joining the World Bank staff, she spent four years in India working on self-advocacy and protection programs with communities affected by conflict and natural disaster. Rachel completed her master's at Georgetown University, with a concentration in Global Politics and Security.

Roku Fukui (World Bank, Digital Development, consultant)—Executive Summary and chapter 4

Roku works as a consultant with the World Bank Group's Digital Development Department. He focuses on various aspects of digital development and has worked primarily in Afghanistan and Somalia. His research interests cover information and communication technology for development and mobile innovation. Roku received his MA in International Economics and International Relations from the Johns Hopkins School of Advanced International Studies. He is an above-average cryptocurrency investor.

Christine Howard (World Bank, Digital Development)—Bibliography and Publication

Christine is a Program Assistant with the Digital Development Department at the World Bank. She joined the World Bank staff in 2012 after graduating with her bachelor's in Political Science and Creative Writing earlier that year. Since joining the staff, she has supported and contributed to multiple digital development-related research, programs, and initiatives. She creates original art, short stories, and poems. Her poetry has been published in *The Dulcimer*, a student-led literary and art magazine.

Tim Kelly (World Bank, Digital Development)—Editor, Executive Summary, and chapters 1, 2, and 5

Tim is a Lead Digital Development Specialist based in Nairobi. He is the editor of this report and the overall Information and Communications Technology for Development series. He worked previously at the Organisation for Economic Co-operation and Development and International Telecommunication Union, having joined the World Bank staff in 2008. His other World Bank publications include the policy chapter in the *2016 World Development Report, Maximizing Mobile*, and *ICTs for Post-conflict Reconstruction*, as well as the *Broadband Strategies Handbook* (with Carlo Rossotto). In addition to his analytical work and technical assistance, he is also co-task team leader for digital development investment lending programs in Comoros, Ghana, Malawi, Niger, Tanzania, and Somalia.

Robert Kirkpatrick (UN Global Pulse)—chapter 3

Robert is the Director of UN Global Pulse, a UN initiative driving a big data revolution for global development and resilience. Prior to joining the UN staff, Robert cofounded and led software development for two pioneering private sector humanitarian technology teams, first at Groove Networks, and later as Lead Architect for Microsoft Humanitarian Systems. From 2007 to 2009 he served as Chief Technology Officer of the nonprofit InSTEDD. Robert was a member of the UN Secretary-General's Independent Expert Advisory Group on a Data Revolution for Sustainable Development (2014) and currently sits on InSTEDD's Board of Directors, as well as the World Economic Forum's Global Agenda Council on Data-Driven Development.

Prasanna Lal Das (World Bank, Finance, Competitiveness, and Innovation)—chapters 5 and 6

Prasanna works on entrepreneurship, data/digital strategy, and disruptive technologies in the Finance, Competitiveness and Innovation Global Practice at the World Bank Group. His most recent publication is “Internet of Things—The Next Government to Business Platform.” His current work includes projects on technologies such as blockchain, Internet of Things, and machine learning applied to development questions such as financial inclusion, growth of small and medium-sized enterprises, and entrepreneurship ecosystem diagnostics. Prasanna managed the Bank Group’s open financial data program and led the development of its open trade and competitiveness data platform. Prasanna holds a master’s degree in Modern Indian History. He can be followed on Twitter @prasannalaldas.

Bradley Larson (World Bank, East Asia Pacific, consultant)—Data Notes

Bradley Larson is a consultant with the Macroeconomics, Trade, and Investment Global Practice, working primarily on issues related to the digital economy of East Asia. Previously, he led data analysis and visualization for three World Development Reports: *Learning to Realize Education’s Promise* (2018), *Governance and the Law* (2017), and *Digital Dividends* (2016). He has also worked for the World Bank’s Public Sector Governance unit, the Special Inspector General for Iraq Reconstruction, and the Center for Strategic and International Studies. He has an MA in International Economics and Strategic Studies from the Johns Hopkins School of Advanced International Studies.

Miguel Luengo-Oroz (UN Global Pulse)—chapter 3

Miguel is the Chief Data Scientist at UN Global Pulse. As the first data scientist at the United Nations, since 2011, Miguel has created and managed teams that have implemented more than 30 innovation projects worldwide with governments and UN agencies. He also advises the government of Spain in regard to its artificial intelligence strategy. He is the founder of MalariaSpot.org at the Universidad Politécnica de Madrid—video games and crowdsourcing for medical diagnosis. Over the last 15 years, he has coauthored more than 40 scientific publications. Prior to joining the United Nations, Miguel worked as an antidisciplinary scientist in French and Spanish institutions in fields like artificial creativity and genetics.

Michael Minges (World Bank, Digital Development, consultant)—chapters 2, 5, and 6 and Data Notes

Michael Minges is the lead consultant at ICTData, where he provides advice and analysis on digital technology issues for a range of clients including governments, the private sector, and international organizations. He previously worked at the International Telecommunication Union and International Monetary Fund. Michael drafted the technology chapter for the World Bank’s *Broadband Strategies Toolkit*. Recent assignments include analyzing the impact of broadband in least developed countries, developing an e-commerce strategy for Oman, and evaluating the Taza Koom digital transformation initiative in the Kyrgyz Republic. He holds an MBA from George Washington University.

Tatiana Nadyseva (World Bank, Digital Development, consultant)—chapter 4

Tatiana joined the World Bank as a consultant to work on the “People and Data” chapter for this report. She previously worked in the sphere of advocacy, gender equality, and information and communication technology-enabled employment, but her real passion lies in the sphere of technological evolution. She received her BSc and postgraduate diploma in Economics from Saint Petersburg University of Engineering and Economics and her MSc in Technology (Operations and Innovation Management) from Aalborg University. Apart from being a tech enthusiast, Tatiana is also an environmentalist, vegan, digital nomad, and photographer.

Siddhartha Raja (World Bank, Digital Development)—chapter 4

Siddhartha Raja is a Digital Development Specialist with the World Bank Group. His work focuses on connecting more people to better and cheaper internet and digital technologies. He has assisted governments in designing and implementing policy reform and investment programs that have expanded broadband connectivity, helped people develop their digital skills and find work online, and generated exponential improvements in international connectivity, bringing people closer to information, markets, and public services. He has a bachelor’s degree in Telecommunications Engineering from the University of Bombay and a master’s degree in Infrastructure Policy Studies from Stanford University, has studied media law and policy at the University of Oxford, and has a doctorate in Telecommunications Policy from the University of Illinois.

Liudmyla (Mila) Romanoff (UN Global Pulse)—chapter 3

Mila is the Legal and Privacy Specialist at the UN Global Pulse, where she leads the data privacy and risk management program and is responsible for establishing legal mechanisms for public-private data partnerships. Mila is the lead drafter of the first UN system-wide framework on data privacy and digital ethics, formally adopted by United Nations Development Group. She currently coordinates the UN Global Pulse Data Privacy Advisory Group and cofacilitates the UN Privacy Policy Group. Previously, she advised two permanent country missions to the UN and worked in the private sector as a commercial contracting and litigation attorney. Mila sits on several legal and privacy associations and privacy advisory boards. She is licensed to practice law in Ukraine and New York.

Carlo Rossotto (World Bank, Digital Development)—chapter 5

Carlo Maria Rossotto is a Lead ICT Specialist at the World Bank and leads the Digital Economy Window of the Digital Development Partnership, the Bank's new Trust Fund Facility bringing together governments and leading technology firms to foster digital development. At the World Bank, he has been responsible for lending and technical assistance operations in Europe, the Middle East, North Africa, and East Asia. Carlo is one of the Bank's leading authorities on broadband and the digital economy. He has advised top-level policy makers on broadband,

technology, and development in over 40 engagements, including the Russian Federation, Ukraine, the European Union, the Arab Republic of Egypt, Algeria, Tunisia, Morocco, and Jordan and in West Bank and Gaza, Cambodia, Bosnia and Herzegovina, Libya, and Iraq. He worked previously at the Inter-American Development Bank and in management consulting, advising leading European technology firms on demand analysis, marketing, corporate strategy, and regulatory affairs. He holds postgraduate degrees in Economics and Business Administration from Bocconi University in Milan and in Financial and Commercial Regulation from the London School of Economics.

Felicia Vacarelu (UN Global Pulse)—chapter 3

Felicia leads communications and social media activities for UN Global Pulse, manages media outreach, and helps build and maintain fruitful relationships with partners. Over the past eight years, she has worked with various UN offices and departments, coming to Global Pulse from the Food and Agriculture Organization in Rome. Prior to working for the United Nations, Felicia was Media and Outreach Coordinator for the 2009 Black Sea Energy and Economic Forum in Romania. She also held several editorial and journalistic positions at Mediafax, one of Romania's most prestigious news agencies. To strengthen her knowledge in the field, she is currently pursuing a master's in Media and Public Relations from the University of Leicester in the United Kingdom.

The Information and Communications for Development series looks in depth at how information and communications technologies are affecting economic growth in developing countries. This new report, the fourth in the series, examines the topic of data-driven development, or how better information makes for better policies. The objective is to assist developing-country firms and governments in unlocking the value of the data they hold for better service delivery and decision making and to empower individuals to take more control of their personal data.

We are undoubtedly experiencing a data revolution in which our ability to generate, process, and utilize information has been magnified many times over by the machines that we increasingly rely upon. This report is about how the data revolution is changing the behavior of governments, individuals, and firms and how these changes affect the nature of development: economic, social, and cultural. How can governments extract value from data to improve service delivery in the same way that private companies have learned to do for profit? Is it feasible for individuals to take ownership of their own data and to use it to improve their livelihoods and quality of life? Can developing-country firms compete with the internet majors on their own turf and be even more innovative in their use of data to serve local customers better? Though the report is aimed primarily at government policy makers, it also has great relevance for individuals concerned about how their personal data is used and how the data revolution might affect their future job prospects. For private sector firms, particularly those in developing countries, the report suggests how they might expand their markets and improve their competitive edge. For development professionals, the report provides guidance on how they might use data more creatively to tackle long-standing global challenges, such as eliminating extreme poverty, promoting shared prosperity, or mitigating the effects of climate change.

The report's chapters explore different themes associated with the supply of data, the technology underlying it, and the demand for it. An overview chapter focuses on government use of data and presentation of definitions. Part I of the report then looks at the "supply side" of the data sector, with chapters on data connectivity and capacity (where data comes from, how it is stored, and where it goes) and data technology (specifically big data analytics and artificial intelligence) and how this is contributing to development. Part II looks at the sector's "demand side," with a chapter on people's use of data and another that examines how firms use digital platforms in the data economy and how that contributes to competitiveness. Part III brings together the policy implications for developing-country stakeholders, with a chapter considering government policies for data, including data protection and privacy. A closing Data Notes appendix looks at statistical indicators associated with the use of data and presents the 2018 update of the Digital Adoption Index (DAI), a composite indicator introduced in the *2016 World Development Report: Digital Dividends*.

DIGITAL DEVELOPMENT PARTNERSHIP



WORLD BANK GROUP

WITH SUPPORT FROM



SKU 33235