UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

UNCTAD

EMBARGO
The contents of this Report must not be quoted or summarized in the print, broadcast or electronic media before
4 September 2019, 17:00 hours GMT

DIGITAL ECONOMY REPORT 2019

VALUE CREATION AND CAPTURE: IMPLICATIONS FOR DEVELOPING COUNTRIES

UNITED NATIONS

UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

UNCTAD

DIGITAL ECONOMY REPORT 2019

VALUE CREATION AND CAPTURE: IMPLICATIONS FOR DEVELOPING COUNTRIES

UNITED NATIONS
Geneva, 2019

United Nations Publications,
300 East 42nd Street,
New York, New York 10017,
United States of America

Email: publications@un.org
Website: un.org/publications

United Nations publication issued by the United Nations Conference on Trade and Development.

UNCTAD/DER/2019

ISBN 978-92-1-112955-7
eISBN 978-92-1-004216-1
Print ISSN 2664-2255
eISSN 2664-2263
Sales No. E.19.II.D.17

Note

Within the UNCTAD Division on Technology and Logistics, the ICT Policy Section carries out policy-oriented analytical work on the development implications of information and communications technologies (ICTs) and e-commerce. It is responsible for the preparation of the *Digital Economy Report*, previously known as the Information Economy Report. The ICT Policy Section promotes international dialogue on issues related to ICTs for development, and contributes to building developing countries' capacities to measure e-commerce and the digital economy and to design and implement relevant policies and legal frameworks. The Section also manages the *eTrade for all* initiative.

In this Report, the terms country/economy refer, as appropriate, to territories or areas. The designations of country groups are intended solely for statistical or analytical convenience, and do not necessarily express a judgement about the stage of development reached by a particular country or area in the development process. Unless otherwise indicated, the major country groupings used in this Report follow the classification of the United Nations Statistical Office. These are:

Developed countries: the member countries of the Organisation for Economic Co-operation and Development (OECD) (other than Chile, Mexico, the Republic of Korea and Turkey), plus the European Union member countries that are not OECD members (Bulgaria, Croatia, Cyprus, Lithuania, Malta and Romania), plus Andorra, Liechtenstein, Monaco and San Marino. *Countries with economies in transition* refers to those in South-East Europe and the Commonwealth of Independent States. *Developing economies* in general are all the economies that are not specified above. For statistical purposes, the data for China do not include those for Hong Kong Special Administrative Region of China (Hong Kong, China), Macao Special Administrative Region of China (Macao, China) or Taiwan Province of China. An excel file with the main country groupings used can be downloaded from UNCTADstat at: http://unctadstat.unctad.org/EN/Classifications.html.

References to Latin America include the Caribbean countries unless otherwise indicated.

References to sub-Saharan Africa include South Africa unless otherwise indicated.

References to the United States are to the United States of America, and to the United Kingdom are to the United Kingdom of Great Britain and Northern Ireland.

The term "dollars" ($) refers to United States dollars, unless otherwise indicated.

The term "billion" signifies 1,000 million.

The following symbols may have been used in the tables:

Two dots (..) indicate that data are not available or are not separately reported.

Rows in tables have been omitted in those cases where no data are available for any of the elements in the row.

A dash (–) indicates that the item is equal to zero or its value is negligible.

A blank in a table indicates that the item is not applicable, unless otherwise indicated.

A slash (/) between dates representing years, e.g. 1994/95, indicates a financial year.

Use of an en dash (–) between dates representing years, e.g. 1994–1995, signifies the full period involved, including the beginning and end years.

Annual rates of growth or change, unless otherwise stated, refer to annual compound rates.

Details and percentages in tables do not necessarily add up to the totals because of rounding.

Preface

The digital revolution has transformed our lives and societies with unprecedented speed and scale, delivering immense opportunities as well as daunting challenges. New technologies can make significant contributions to realizing the Sustainable Development Goals, but we cannot take positive outcomes for granted. We must urgently improve international cooperation if we are to achieve the full social and economic potential of digital technology, while avoiding unintended consequences.

Given the high stakes involved, I established a High-level Panel on Digital Cooperation to help expand understanding of the key digital opportunities and challenges before us. The Panel brought together diverse experts and put forward a wide range of recommendations, including on how to better govern digital technology development through open, agile and multi-stakeholder models.

In that same spirit and in today's fast-changing environment, I welcome this timely *Digital Economy Report* of the United Nations Conference on Trade and Development, which examines the implications of the digital economy, especially for developing countries.

Digital advances have generated enormous wealth in record time, but that wealth has been concentrated around a small number of individuals, companies and countries. Under current policies and regulations, this trajectory is likely to continue, further contributing to rising inequality. We must work to close the digital divide, where more than half the world has limited or no access to the Internet. Inclusivity is essential to building a digital economy that delivers for all.

New technologies, especially artificial intelligence, will inevitably lead to a major shift in the labour market, including the disappearance of jobs in some sectors and the creation of opportunities in others, on a massive scale. The digital economy will require a range of new and different skills, a new generation of social protection policies, and a new relationship between work and leisure. We need a major investment in education, rooted not just in learning but in learning how to learn, and in providing lifelong access to learning opportunities for all.

The digital economy has also created new risks, from cybersecurity breaches to facilitating illegal economic activities and challenging concepts of privacy. Governments, civil society, academia, the scientific community and the technology industry must work together to find new solutions.

Not a day passes for me without seeing the many ways in which digital technology can advance peace, human rights and sustainable development for all. This report offers valuable insights and analyses, and I commend it to a wide global audience as we strive together to ensure that no one is left behind by the fast-evolving digital economy.

António Guterres
Secretary-General
United Nations

Foreword

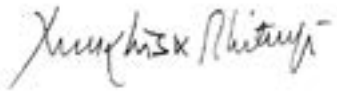
The rapid spread of digital technologies is transforming many economic and social activities. However, widening digital divides threaten to leave developing countries, and especially least developed countries, even further behind. A smart embrace of new technologies, enhanced partnerships and greater intellectual leadership are needed to redefine digital development strategies and the future contours of globalization.

This first edition of the *Digital Economy Report* – previously known as the *Information Economy Report* – examines the implications of the emerging digital economy for developing countries in terms of value creation and capture. It highlights the two main drivers of value creation in the digital era – digital data and platformization – and explores how current trends of wealth concentration could be replaced by trajectories leading to more equitable sharing of the gains from digitalization.

These are still early days in the digital era, and we have more questions than answers about how to deal with the digital challenge. Given the absence of relevant statistics and empirical evidence, as well as the rapid pace of technological change, decision-makers face a moving target as they try to adopt sound policies relating to the digital economy.

UNCTAD is committed to accompanying its member States with evidence for informed decision-making, as they consider different policy options and practices aimed at benefiting from the digital economy. Beyond our research on the digital economy, our Intergovernmental Group of Experts on E-Commerce and the Digital Economy and the annual eCommerce Week provide valuable forums for policy dialogue. We also offer technical assistance and capacity-building, and seek to make such support more transparent and easily accessible through the *eTrade for all* initiative and its 30 partner organizations.

It is my hope that this holistic approach will respond to the desire of people in developing countries to take part in the new digital world, not just as users and consumers, but also as producers, exporters and innovators, for creating and capturing more value on their path towards sustainable development.



Mukhisa Kituyi
Secretary-General
United Nations Conference on Trade and Development

Acknowledgements

The *Digital Economy Report 2019* was prepared under the overall guidance of Shamika N. Sirimanne, Director of the Division on Technology and Logistics, by a team comprising Torbjörn Fredriksson and Pilar Fajarnes Garces (team leaders), Scarlett Fondeur Gil, Christopher Jones, Martine Julsaint Kidane, Diana Korka and Thomas van Giffen.

The Report benefited from major substantive inputs provided by Christopher Foster, Nicolas Friederici, Parminder Jeet Singh, Michael Minges and Nick Srnicek. Additional inputs were contributed by Anna Abramova, Janine Berg, Ebru Gokce, Lukonga Lindunda, Christoph Spennemann, Astrit Sulstarova and Attiya Waris.

Valuable comments were received by experts attending a Brainstorming Meeting in May 2018 and a Peer Review Meeting in February 2019, both in Geneva. The experts included Jim Bennett, Carla Bonina, Suaihua Cheng, Jonathan Donner, Paul Donohoe, Helani Galpaya, Michael Kende, Isya Hanum Kresnadi, James Howe, Massimo Meloni, Thao Nguyen, Nnenna Nwakanma, David Souter, Giovanni Valensisi, Desirée van Welsum and Anida Yupari. Further comments and inputs were received at various stages of production of the Report from Joerg Mayer and Holger Schmidt.

UNCTAD greatly appreciates additional inputs from the Economic Commission for Latin America and the Caribbean, the Economic and Social Commission for Asia and the Pacific, the Economic and Social Commission for Western Asia and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). In addition, Eurostat, the International Labour Organization and the International Telecommunication Union generously shared their data, which is also highly appreciated.

UNCTAD is grateful to national statistical offices for their sharing of data and for the responses of member States to UNCTAD's annual survey questionnaire on their ICT sectors and on ICT usage by enterprises.

The cover and other graphics were prepared by Magali Studer and desktop publishing was done by Magali Studer and Nathalie Loriot. Infographics were done by Natalia Stepanova and the *Digital Economy Report 2019* was edited by Praveen Bhalla.

Financial support from the Government of Germany is gratefully acknowledged.

Contents

Boxes

Tables

Annexes

Annex figure

Figures

List of Abbreviations

3D	3 dimensional
AI	artificial intelligence
API	application programming interface
B2B	business to business
B2C	business to customer
BEA	Bureau of Economic Analysis (United States)
BEPS	base erosion of profit shifting
C2C	consumer to consumer
CBDF	cross-border data flow
D4D	digital for development
ERP	enterprise resource planning
EU	European Union
FCO	Federal Cartel Office (of Germany)
FRAND	fair, reasonable and non-discriminatory
FTA	free trade agreement
GB	gigabyte
G2C	government to consumer
GDP	gross domestic product
GDPR	General Data Protection Regulation (EU)
GVC	global value chain
ICT	information and communications technology
ILO	International Labour Organization
ISIC	International Standard Industrial Classification
IMF	International Monetary Fund
IoT	Internet of things
IP	Internet protocol (but also intellectual property)
IPR	intellectual property right
IPO	initial public offering
IT	information technology
ITES	IT-enabled services
ITU	International Telecommunication Union
IXP	Internet exchange point
LMIC	low- and middle-income countries
MNE	multinational enterprise
MSMEs	micro, small and medium-sized enterprises
ODA	official development assistance
OECD	Organisation for Economic Co-operation and Development
PPP	public-private partnership
QoS	quality of service
R&D	research and development
RFID	radio frequency identification
SDG	Sustainable Development Goal
UNCTAD	United Nations Conference on Trade and Development
WTO	World Trade Organization

Overview

The *Digital Economy Report (DER)* (formerly known as the Information Economy Report) this year examines the scope for value creation and capture in the digital economy by developing countries. It gives special attention to opportunities for these countries to take advantage of the data-driven economy as producers and innovators – but also to the constraints they face – notably with regard to digital data and digital platforms.

This topic is timely, as only a decade remains for achieving the sustainable development goals (SDGs). Digital disruptions have already led to the creation of enormous wealth in record time, but this is highly concentrated in a small number of countries, companies and individuals. Meanwhile, digitalization has also given rise to fundamental challenges for policymakers in countries at all levels of development. Harnessing its potential for the many, and not just the few, requires creative thinking and policy experimentation. And it calls for greater global cooperation to avoid widening the income gap.

The digital economy's expansion is driven by digital data…

The digital economy continues to evolve at breakneck speed, driven by the ability to collect, use and analyse massive amounts of machine-readable information (digital data) about practically everything. These digital data arise from the digital footprints of personal, social and business activities taking place on various digital platforms. Global Internet Protocol (IP) traffic, a proxy for data flows, grew from about 100 gigabytes (GB) *per day* in 1992 to more than 45,000 GB *per second* in 2017. And yet the world is only in the early days of the data-driven economy; by 2022 global IP traffic is projected to reach 150,700 GB per second, fuelled by more and more people coming online for the first time and by the expansion of the Internet of Things (IoT).

The development and policy implications of data collection and use depend greatly on the type of data involved: personal or non-personal; private or public; for commercial or government purposes; volunteered, observed or inferred; sensitive or non-sensitive. An entirely new "data value chain" has evolved, comprising firms that support data collection, the production of insights from data, data storage, analysis and modelling. Value creation arises once the data are transformed into digital intelligence and monetized through commercial use.

… and digital platforms

Platformization is the second driver. In the past decade, a plethora of digital platforms have emerged around the world using data-driven business models, and disrupting existing industries in their wake. The power of platforms is reflected in the fact that seven of the world's top eight companies by market capitalization use platform-based business models.

Digital platforms provide the mechanisms for bringing together a set of parties to interact online. A distinction can be made between transaction platforms and innovation platforms. *Transaction platforms* are two/multi-sided markets with an online infrastructure that supports exchanges between a number of different parties. They have become a core business model for major digital corporations (such as Amazon, Alibaba, Facebook and eBay), as well as for those that are supporting digitally enabled sectors (such as Uber, Didi Chuxing or Airbnb). *Innovation platforms* create environments for code and content producers to develop applications and software in the form of, for example, operating systems (e.g. Android or Linux) or technology standards (e.g. MPEG video).

Platform-centred businesses have a major advantage in the data-driven economy. As both intermediaries and infrastructures, they are positioned to record and extract all data related to online actions and interactions among users of the platform. The growth of digital platforms is directly linked to their capacity to collect and analyse digital data, but their interests and behaviour depend greatly on how they monetize those data to generate revenue.

Geographically, the development of the digital economy is highly uneven

Digital developments will have implications for virtually all the SDGs, and will affect all countries, sectors and stakeholders. At present, the world is characterized by a yawning gap between the under-connected and the hyper-digitalized countries. For example, in least developed countries (LDCs), only one in five people

uses the Internet as compared with four out of five in developed countries. This is just one aspect of the digital divide. In other areas, such as capabilities for harnessing digital data and frontier technologies, the gap is considerably wider. For example, Africa and Latin America together account for less than 5 per cent of the world's colocation data centres. If left unaddressed, these divides will exacerbate existing income inequalities. It is therefore essential to consider how developing countries may be affected by this (r)evolution in terms of the creation and capture of value, and what should be done to improve the status quo.

The economic geography of the digital economy does not display a traditional North-South divide. It is consistently being led by one developed and one developing country: the United States and China. For example, these two countries account for 75 per cent of all patents related to blockchain technologies, 50 per cent of global spending on IoT, and more than 75 per cent of the world market for public cloud computing. And, perhaps most strikingly, they account for 90 per cent of the market capitalization value of the world's 70 largest digital platforms. Europe's share is 4 per cent and Africa and Latin America's together is only 1 per cent. Seven "super platforms" – Microsoft, followed by Apple, Amazon, Google, Facebook, Tencent and Alibaba – account for two thirds of the total market value. Thus, in many digital technological developments, the rest of the world, and especially Africa and Latin America, are trailing considerably far behind the United States and China. Some of the current trade frictions reflect the quest for global dominance in frontier technology areas.

What is value in the digital economy?

The expansion of the digital economy creates many new economic opportunities. Digital data can be used for development purposes and for solving societal problems, including those related to the SDGs. It can thus help improve economic and social outcomes, and be a force for innovation and productivity growth. Platforms facilitate transactions and networking as well as information exchange. From a business perspective, the transformation of all sectors and markets through digitalization can foster the production of higher quality goods and services at reduced costs. Furthermore, digitalization is transforming value chains in different ways, and opening up new channels for value addition and broader structural change.

But positive outcomes are far from automatic. Just because digitalization has the potential to support development, any value realized is unlikely to be equitably distributed. Even if individuals, firms and countries do not – or only partially – take part in the digital economy, they can still be adversely affected indirectly. Workers with limited digital skills will find themselves at a disadvantage vis-à-vis those who are better equipped for the digital economy, incumbent local firms will meet stiff competition from digitalized domestic and foreign ones, and various jobs will be lost to automation. The net impact will depend on the level of development and digital readiness of countries and their stakeholders. It will also depend on the policies adopted and implemented at national, regional and international levels.

Impacts on value creation and capture can be considered across several economic dimensions (e.g. productivity, value added, employment, income and trade), for different actors (workers, micro, small and medium-sized enterprises (MSMEs)), platforms and governments), and for different components of the digital economy (core, narrow and broad in scope).

Measuring value in the digital economy is difficult

Measuring the digital economy and related value creation and capture is fraught with difficulties. Firstly, there is no widely accepted definition of the digital economy. Secondly, reliable statistics on its key components and dimensions, especially in developing countries, are lacking. Although several initiatives are under way to improve the situation, they remain insufficient, and are struggling to cope with the rapid pace of evolution of the digital economy.

Depending on the definition, estimates of the size of the digital economy range from 4.5 to 15.5 per cent of world GDP. Regarding value added in the information and communications technology (ICT) sector, the United States and China together account for almost 40 per cent of the world total. As a share of GDP, however, the sector is the largest in Taiwan Province of China, Ireland and Malaysia. Global employment in the ICT sector increased from 34 million in 2010 to 39 million in 2015, with computer services accounting for the largest share (38 per cent). The share of the ICT sector in total employment rose over the same period, from 1.8 per cent to 2 per cent.

Within the ICT sector, computer services are the largest component, with a 40 per cent share of total value added. The global computer services industry is dominated by the United States; its share of that industry's value added is almost as big as that of the combined total of the next nine largest economies. India has the largest share among developing countries in this context. Computer services, which is the only subsector that is growing across all regions, is one of the main drivers of employment in the sector. Value added in ICT manufacturing is highly concentrated in East Asia (led by China), and the scope for more developing countries to extract value from this sector is likely to be limited.

In the past decade, global exports of ICT services and services that can be delivered digitally grew considerably faster than overall services exports, reflecting the increasing digitalization of the world economy. In 2018, digitally deliverable service exports amounted to $2.9 trillion, or 50 per cent of global services exports. In LDCs, such services accounted for an estimated 16 per cent of total services exports, and they more than tripled from 2005 to 2018.

The growing power of digital platforms has global implications

Digital platforms are increasingly important in the world economy. The combined value of the platform companies with a market capitalization of more than $100 million was estimated at more than $7 trillion in 2017 – 67 per cent higher than in 2015. Some global digital platforms have achieved very strong market positions in certain areas. For example, Google has some 90 per cent of the market for Internet searches. Facebook accounts for two thirds of the global social media market, and is the top social media platform in more than 90 per cent of the world's economies. Amazon boasts an almost 40 per cent share of the world's online retail activity, and its Amazon Web Services accounts for a similar share of the global cloud infrastructure services market. In China, WeChat (owned by Tencent) has more than one billion active users and, together with Alipay (Alibaba), its payment solution has captured virtually the entire Chinese market for mobile payments. Meanwhile, Alibaba has been estimated to have close to 60 per cent of the Chinese e-commerce market.

Several factors help explain the rapid rise to dominance of these digital giants. The first is related to network effects (i.e. the more users on a platform, the more valuable it becomes for everyone). The second is the platforms' ability to extract, control and analyse data. As with network effects, more users mean more data, and more data mean a stronger ability to outcompete potential rivals and capitalize on first-mover advantages. Thirdly, once a platform begins to gain traction and starts offering different integrated services, the costs to users of switching to an alternative service provider start to increase.

Global digital platforms have taken steps to consolidate their competitive positions, including by acquiring potential competitors and expanding into complementary products or services. Major acquisitions by digital platform companies include Microsoft's takeover of LinkedIn and Facebook's acquisition of WhatsApp. Alphabet (Google) and Microsoft have invested in telecommunications equipment by acquiring Motorola and Nokia, respectively. Major platforms have also made other large acquisitions in the retail industry, advertising and marketing industry, and in non-residential real estate.

Other steps include investing strategically in research and development (R&D) and lobbying in domestic and international policy-making circles. At the same time, strategic partnering between multinational enterprises (MNEs) in traditional sectors and global digital platform corporations is also being explored. For example, Walmart has partnered with Google to use Google Assistant; Ford and Daimler have joined Baidu in its Apollo platform; Google has built the Android Automotive platform with Volvo and Audi; GE has partnered with Microsoft to use its Azure cloud services; and Intel and Facebook are collaborating on the development of a new artificial intelligence (AI) chip.

Turning data into digital intelligence is the key to success

Data have become a new economic resource for creating and capturing value. Control over data is strategically important to be able to transform them into digital intelligence. In virtually every value chain, the ability to collect, store, analyse and transform data brings added power and competitive advantages. Digital data are core to all fast-emerging digital technologies, such as data analytics, AI, blockchain, IoT, cloud computing and all Internet-based services. Unsurprisingly, data-centric business models are being adopted not only by digital platforms, but also, increasingly, by lead companies across various sectors.

Local firms in developing countries can benefit from being able to use services offered by global platforms. In some cases, local knowledge (for instance, of search habits, traffic conditions and cultural nuances) may also give an advantage to locally rooted digital platforms, enabling them to offer services tailored to local users. Yet, due to the competition dynamics outlined above, developing-country platforms that are trying to scale typically face an uphill battle. The dominance of global digital platforms, their control of data, as well as their capacity to create and capture the ensuing value, tend to further accentuate concentration and consolidation rather than reduce inequalities between and within countries.

Indeed, in the global "data value chain", many countries may find themselves in subordinate positions, with value and data being concentrated in a few global platforms and other lead MNEs. Countries at all levels of development risk becoming mere providers of raw data to those digital platforms while having to pay for the digital intelligence produced with those data by the platform owners. Breaking this vicious circle will require out-of-the-box thinking aimed at finding an alternative configuration of the digital economy that leads to more balanced results and a fairer distribution of the gains from data and digital intelligence.

Policies are needed to make the digital economy work for the many, not just the few

Technology is not deterministic. It creates both opportunities and challenges. It is up to governments, in close dialogue with other stakeholders, to shape the digital economy by defining the rules of the game. This in turn requires a reasonable sense of the kind of digital future that is desirable. Policymakers need to make choices that can help reverse current trends towards widening inequalities and power imbalances wrought by the digital economy. This is a huge challenge that will involve the adaptation of existing policies, laws and regulations, and/or the adoption of new ones in many areas. For most countries, the digital economy and its long-term repercussions remain unchartered territory, and policies and regulations have not kept up with the rapid digital transformations taking place in economies and societies. Even in developed countries, few approaches have been tried and tested.

The evolution of the digital economy calls for unconventional economic thinking and policy analysis. Policy responses need to take into account the blurring of the boundaries between sectors due to servitization, as well as the increased difficulties of enforcing national laws and regulations with respect to cross-border trade in digital services and products. They should also explore new pathways for local value creation and capture, and further structural transformation through digitalization.

While some issues can be addressed through national policies and strategies, the global nature of the digital economy will require more dialogue, consensus-building and policy-making at the international level. At this stage there are many more questions than definitive answers about how to deal with the digital economy. Given the paucity of relevant statistics and empirical evidence, as well as the rapid pace of technological change, findings and policy responses will need to be constantly reassessed.

Enhancing readiness to create and capture value

National policies play a vital role in preparing countries for value creation and capture in the digital era. In view of the cross-sectoral nature of digitalization, a whole-of-government response is important to the formulation and implementation of policies aimed at securing benefits and dealing with challenges. Ensuring affordable and reliable connectivity, which is essential for creating and capturing value in the digital economy, remains a major challenge in many LDCs, especially in rural and remote areas, and requires attention. UNCTAD's Rapid eTrade Readiness Assessments can serve as a useful starting point for LDCs and other countries by identifying areas for improvement and policy interventions that could help alleviate bottlenecks.

Boosting entrepreneurship in digital and digitally enabled sectors is key to local value creation. In many developing countries, digital entrepreneurs face various barriers to scaling their activities. Global digital competitors already occupy the most scalable digital product categories. Servicing local markets digitally often requires the setting up of blended digital-analog processes, which are less "physical-asset-light" than the strategies used by digital platforms in more advanced economies.

In most developing countries, market opportunities may lie especially in local and/or regional digital goods and services markets. Policy can seek to incentivize different clusters within a region to develop complementary and deep technical knowledge bases. The greatest potential may lie in digital products that

are hard to be replicated elsewhere, that are needed locally, and that can be transported or duplicated in a certain location at relatively low cost. Governments could focus less on hackathons and bootcamps or high-profile projects (such as technology parks), and more on fostering tacit entrepreneurial knowledge creation through mentorship programmes, vocational training, apprenticeships and internships.

They should also consider ways of empowering women entrepreneurs in this area. Mentoring, networking and exposing them to role models can help overcome inherent gender biases or cultural norms that may limit women's ability to confidently start or sustain projects in e-commerce and data-driven technology areas.

Securing value from the digital economy requires not just a stronger digital sector, but also broader efforts to enable enterprises in all sectors to take advantage of digital technologies. In many LDCs, for example, this concerns, in particular, agriculture and tourism. Firms that invest in ICTs are generally more productive, competitive and profitable. However, many small business owners in developing countries, and especially in LDCs, lack the capabilities, skills and awareness to leverage digital connectivity for their business operations. One way to address this is to integrate ICT skills development into general business-management training curricula. Governments should also consider collaborating with the private sector to provide more training to MSMEs on how to leverage digital platforms.

Policies for harnessing digital data

Countries with limited capabilities to turn digital data into digital intelligence and business opportunities are at a clear disadvantage when it comes to value creation. To prevent increased dependence in the data-driven global economy, national development strategies should seek to promote digital upgrading (value addition) in data value chains, and to enhance domestic capacities to "refine" the data. This may require national policies to better seize opportunities and deal with the risks and challenges associated with the expansion of digital data. Key policy questions include how to assign ownership and control over data; how to build consumer trust and protect data privacy, how to regulate cross-border data flows, and how to build relevant skills and capabilities for harnessing digital data for development.

Various proposals have been made to ensure a more equitable sharing of the economic gains from digital data. Some focus on remunerating the individuals who are sharing the data with platforms through personal data markets or via data trusts. Others call for the use of collective data ownership and of digital data funds as a basis for a new "digital data commons". It will be necessary to experiment with these and other options, and assess their feasibility and respective pros and cons.

Data privacy and data security require special attention. Various security arrangements are important to protect against deliberate acts of data misuse. Laws and regulations are needed to counter theft of personal data, to set rules for what and how personal data can be collected, used, transferred or removed, and to ensure that data-driven business models generate gains for society as a whole. The European Union's General Data Protection Regulation, which took effect in May 2018, is currently the most comprehensive approach to data protection, with global implications.

The digital era requires updating of competition and taxation policies

Given the network effects and the tendency towards market concentration in the digital economy, competition policy will have to play a more important role in the context of creating and capturing value. Existing frameworks need to be adapted to provide for competitive and contestable markets in the digital era. The current dominant approach in antitrust regulations is based on measuring harm to consumers in the form of higher prices. It should be broadened to consider, for example, consumer privacy, personal data protection, consumer choice, market structure, switching costs and lock-in effects. In addition, an appropriate competition policy should be put in place and enforced within regional or global frameworks.

There are different ways for enforcement of competition law to be made more effective vis-à-vis dominant digital players, for example by carefully defining the relevant market, assessing possible abuse of market power and updating the tools for merger reviews. To the extent that services provided could be compared with utilities, regulation should be considered as a tool for ensuring open and fair access for all businesses. Whichever option is chosen, developing countries need to strengthen their capacity to enforce their competition policies. Efforts at the regional and global levels may be more effective in dealing with abusive

practices and merger reviews, and for ensuring that dominant platforms are open to local and regional companies under fair terms and conditions.

Taxation is another key concern for value capture. Countries are rethinking how taxation rights should be allocated to prevent possibilities for under-taxation of major digital platforms in the fast-evolving digital economy. Observers have noted a mismatch between where profits are currently taxed, and where and how value is created. As developing countries are mainly markets for global digital platforms, and their users contribute significantly to the generation of value and profits, authorities in these countries should have the right to tax such platforms. Under the auspices of the OECD, different options are being reviewed with the goal of reaching consensus on a solution by the end of 2020. As the tax landscape evolves in the coming years, it is essential to ensure wide and more inclusive participation of developing countries in international discussions on taxation of the digital economy, including strengthening the United Nations Committee of Experts on International Cooperation in Tax Matters.

Acknowledge the need for speed, flexibility and international support

If left unaddressed, the yawning gap between the under-connected and the hyper-digitalized countries will widen further and existing inequalities will be exacerbated. Digital divides, differences in readiness and the high concentration of market power in the digital economy all point to the need for new policies and regulations that will help create a fairer distribution of gains from the ongoing process of digital transformation. This will not be easy.

Digitalization affects different countries in different ways, and individual governments require policy space to regulate the digital economy in order to fulfil various legitimate public policy objectives. The handling and regulation of digital data are complex, as they touch upon human rights, trade, economic value creation and capture, law enforcement and national security. Formulating policies that take these various dimensions into account is hard, but nonetheless necessary. Furthermore, ensuring an effective distribution of gains, as well as coping with digital disruptions, will require more social protection measures and efforts to reskill workers.

Meanwhile, several policy challenges may be more effectively addressed at the regional or international level. This applies, for example, to data protection and security, cross-border data flows, competition, taxation and trade. Finding adequate solutions requires greater international collaboration and policy dialogue, with the full involvement of developing countries. Any consensus will need to incorporate significant flexibilities to enable all countries to participate.

Given the complexity and novelty of the issues at stake, and the continuously rapid pace of technological change, policy experimentation will be necessary to assess the benefits and disadvantages of different options. The use of regulatory sandboxes could be a first step before moving to fully national, regional or global solutions.

The development community will need to explore more comprehensive ways to support countries that are trailing in the digital economy. For ensuring that digital transformation contributes to more inclusive outcomes, national efforts in developing countries should be complemented by more international support. Development partners urgently need to integrate the digital dimension into their aid policies and strategies. Assistance should aim at reducing the digital divides, strengthening the enabling environment for value creation, building capacities in the private and public sectors, and enhancing trust by supporting the adoption and enforcement of relevant laws and regulations to promote value creation and capture in the data-driven digital economy.

The world economy is transforming fast as a result of the rapid spread of new digital technologies, with major implications for Agenda 2030 on Sustainable Development. Greater levels of digitalization of both economies and societies are creating new means for tackling global development challenges; however, there are risks that digital disruptions will favour mainly those that are already well prepared to create and capture value in the digital era, rather than contribute to more inclusive development.

This chapter sets the stage for the Report by defining the digital economy, and examining trends associated with several emerging digital technologies that all rely on the growth of digital data. The analysis points to a very high level of geographical concentration, with the United States and China occupying the lead in many areas of digital technological development, and most other countries trailing far behind. Variations both among and within countries in the levels of digital connectivity and readiness to benefit from the digital economy are creating concerns for governments, especially in developing countries. Special attention needs to be given to ways that can enable more countries to take advantage of the data-driven digital economy, as producers, innovators and exporters.

RECENT TRENDS IN THE DIGITAL ECONOMY

1

RECENT TRENDS IN THE DIGITAL ECONOMY

The evolving digital economy

is closely associated with several frontier technologies and **fuelled by data**

- Blockchain
- Data analytics
- Artificial intelligence
- 3D printing
- Internet of Things
- Automation & Robotics
- Cloud computing

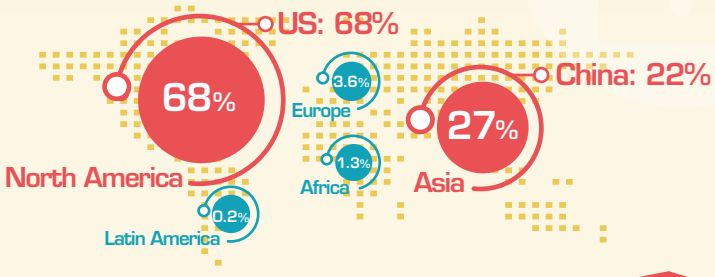
Global Internet Protocol traffic, a proxy for data flows, has grown dramatically, but the world is only in the early days of the data-driven economy

1992	2002	2017	2022
100 gigabytes (GB) of traffic **per day**	**100** GB **per second**	**46,600** GB **per second**	**150,700** GB **per second**

Geography of the digital economy is highly concentrated in two countries

● United States and China ● Rest of the world

- **75%** of all patents related to **blockchain technologies**
- **50%** of global spending on **IoT**
- **>75%** of the **cloud computing** market
- **US and China: 90%** of the market capitalization value of the world's **70 largest digital platforms**



Still huge digital divides

- **Half** of the world remains **offline**
- In **LDCs** only **1 in 5** people are **online**
- **Gender gap** is the widest in the poorest economies

A. ON THE CUSP OF A NEW DIGITAL ERA

The world economy is transforming due to the rapid evolution and growing use of information and communications technologies (ICTs). Although the pace of digital transformation varies, all countries are being affected. This has significant implications for the implementation of the 2030 Agenda for Sustainable Development, presenting major opportunities as well as challenges for developing countries.

One of the distinguishing features of recent years has been the exponential growth in the aggregation of machine-readable information, or digital data, over the Internet. This has been accompanied by an expansion of big data analytics, artificial intelligence (AI), cloud computing and new business models (digital platforms). With more devices accessing the Internet, an ever-increasing number of people using digital services and more value chains being digitally connected, the role of digital data and technologies is set to expand further. As a result, access to data and the ability to transform data into digital intelligence have become crucial for the competitiveness of companies. Producers and exporters are becoming increasingly dependent on data analytics as operations get more digitized, and because they use support services that require access to data such as shipping and transportation, retail distribution and finance.

The transformative power of data for economic and social interactions compels governments, businesses and people to adapt in order to seize opportunities that are emerging, as well as to deal with pitfalls and risks. The ability of various stakeholders to master digital transformations varies considerably. In fact, there is a yawning gap between the under-connected and the hyper-digitalized countries. If left unaddressed, this divide will widen further and exacerbate existing inequalities. Given the far-reaching and highly significant impacts expected from digitalization, UNCTAD is changing the name of this flagship publication from its former title of Information Economy Report to the *Digital Economy Report*.

The notion of the digital economy has become commonplace to describe how digital technology is changing patterns of production and consumption. While the geographic focus of the digital economy was initially on developed countries, its implications have a global reach, and also increasingly affect developing countries in multiple ways. Thus, analyses of the digital economy need to pay serious attention to its development dimension.[1]

This first edition of the *Digital Economy Report* focuses on how to create and capture value in the digital economy. Most of the debate on digitalization and development hitherto has concentrated on the extent to which countries have affordable access to various technologies and whether the technologies are being used. The objective of this Report is to go a step further and discuss the scope for value creation and capture. In particular, it considers how developing countries may be affected by data-driven economic activities and business models (notably digital platforms), and how their roles as producers and innovators can be facilitated in this evolving economic landscape.

In order to set the stage for the rest of the Report, this chapter starts by defining the digital economy. It then examines recent trends and prospects in emerging digital technologies, especially in developing countries. In view of the rising role of data in the digital economy, trends in digital-data-related industries are covered next. The chapter then revisits the more traditional approaches to examining the digital divide, including ICT access and use, and examines the evolution of e-commerce. The subsequent section illustrates how the global business landscape is changing in the digital economy. The chapter ends by providing some conclusions and a roadmap to the rest of the report.

B. WHAT IS THE DIGITAL ECONOMY?

As the world is only at the early stages of digitalization, the evolving digital economy and several other related economic terms lack widely accepted definitions. There may be many interpretations of the same term in the relevant literature and analyses, as well as in different forums. This is because of the novelty and the lack of sufficient understanding or clarity regarding this phenomenon. It may also reflect the high speed of technological progress. The time required for agreeing on standard definitions often lags behind the velocity of technological change.

In this context, it is necessary to strike a balance between avoiding straitjacketing definitions, which may block progress, and reaching a common understanding of relevant concepts. In a rapidly evolving situation, it is important to have some dynamic flexibility with definitions. On the other hand, in order to properly analyse the issues and design policy

responses, there is a need to arrive at some common ground on the meaning of the terminology used. This section provides some historical background on the digital economy concept, and presents a working definition of the digital economy and its components that will serve as the basis for the analysis conducted in this Report.

1. Evolution of the digital economy concept

Since first coined in the mid-1990s, the definition of the digital economy has evolved, reflecting the rapidly changing nature of technology and its use by enterprises and consumers (Barefoot et al., 2018).

In the late 1990s, analyses were mainly concerned with the adoption of the Internet and early thinking about its economic impacts (with reference to the "Internet economy") (Brynjolfsson and Kahin, 2002; Tapscott, 1996). As Internet use expanded, reports from the mid-2000s onwards focused increasingly on the conditions under which the Internet economy might emerge and grow. Definitions evolved to include analyses of different policies and digital technologies, on the one hand, and the growth of ICT and digitally oriented firms as key actors, on the other (OECD, 2012a and 2014). With improved Internet connectivity in developing countries, and the expansion in the range of digital firms, products and services, studies of the digital economy have begun to include more substantial analyses of the situation in developing countries (UNCTAD, 2017a; World Bank, 2016).[2]

In the past few years, the discussion has again shifted, focusing more on the way digital technologies, services, products, techniques and skills are diffusing across economies. This process is often referred to as *digitalization*, defined as the transition of businesses through the use of digital technologies, products and services (Brennen and Kreiss, 2014).[3] Digital products and services are facilitating more rapid change across a wider range of sectors rather than being confined to those high-technology sectors that had been the main focus previously (Malecki and Moriset, 2007). Reflecting this change, recent work has focused on "digitalization" and "digital transformation" (i.e. the ways in which digital products and services are increasingly disrupting traditional sectors) to explore various cross-sectoral digitalization trends (OECD, 2016a and 2017a; UNCTAD, 2017a). This is especially relevant for developing countries where the digital economy has begun to affect the traditional sectors, such as agriculture, tourism and transportation. Indeed, the most important economic changes may well occur through the digitalization of traditional sectors rather than through the emergence of new, digitally enabled sectors.

An analysis of how investments in, and policies related to, technologies or infrastructure enable or limit the emergence of the digital economy is necessary for understanding its development implications. Equally important is to assess the digital economy through the lens of certain sets of technologies. As highlighted by UNCTAD (2017a), for example, the evolving digital economy can be associated with an increased use of advanced robotics, AI, the Internet of things (IoT), cloud computing, big data analytics and three-dimensional (3D) printing. In addition, interoperable systems and digital platforms are essential elements of the digital economy. However, there is always a risk of paying too much attention to the latest innovations that are most in vogue, rather than to those technologies that are of the greatest relevance for developing countries.[4] One way to overcome this limitation is to explore the main components of the digital economy.

2. Main components of the digital economy

With digital technologies underpinning ever more transactions, the digital economy is becoming increasingly inseparable from the functioning of the economy as a whole. The different technologies and economic aspects of the digital economy can be broken down into three broad components:[5]

i. **Core aspects** or foundational aspects of the digital economy, which comprise fundamental innovations (semiconductors, processors), core technologies (computers, telecommunication devices) and enabling infrastructures (Internet and telecoms networks).

ii. **Digital and information technology (IT) sectors**, which produce key products or services that rely on core digital technologies, including digital platforms, mobile applications and payment services. The digital economy is to a high degree affected by innovative services in these sectors, which are making a growing contribution to economies, as well as enabling potential spillover effects to other sectors.

iii. **A wider set of digitalizing sectors**, which includes those where digital products and services are being increasingly used (e.g. for e-commerce). Even if change is incremental, many sectors of the economy are being digitalized in this way. This includes digitally enabled sectors in which new activities or business models have emerged and are being transformed as a result of digital technologies. Examples include finance, media, tourism and transportation. Moreover, although less often highlighted, digitally literate or skilled workers, consumers, buyers and users are crucial for the growth of the digitalized economy.

These components are being used in various ways as a basis for measuring the extent and impact of the digital economy. At their most basic level, methodologies focus on measures of the core and digital/IT sectors (or suitable proxies), notably related to investment and policies relating to the digital economy (e.g. digital infrastructure investments, broadband adoption), and how these are linked to the growth of that economy, particularly in terms of outputs and employment in the digital and digitally enabled sectors (OECD, 2017a; UNCTAD 2017a and b). Such analyses help to provide direction for policies and investments in the digital economy, and to assess potential impacts on firms, consumers and workers.

Measuring the digital economy beyond digital and digitally enabled sectors is more difficult. Impacts from the use of digital technologies may result from spillover effects, and intangible outcomes (such as firm flexibility, management approaches or productivity) also depend on other variables (Brynjolfsson, 1993). Some studies have assessed digitalization by means of surveys and e-commerce data,[6] by measuring the spillover effects from the ICT/digital sectors across an economy (Barefoot et al., 2018; Knickrehm et al., 2016), or by exploring the changing geography of global data and knowledge (Manyika et al., 2014; Ojanperä et al., 2016). These approaches often face limitations due to methodological challenges and the lack of reliable statistics (see also chapter III).

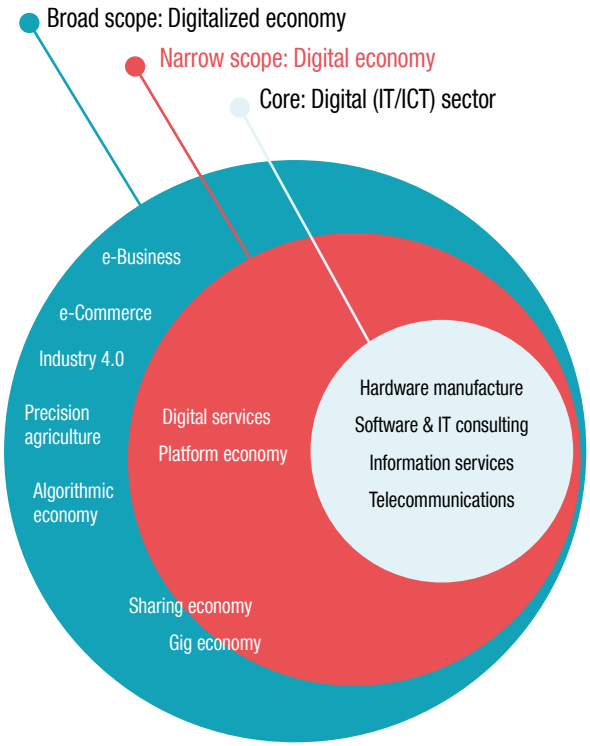
Proposed definitions of the digital economy tend to be closely linked to the components outlined above. One approach, which is broadly aligned with a number of other studies (e.g. Barefoot et al., 2018; OECD, 2012a; UNCTAD, 2017a),[7] is the definition of the digital economy proposed by Bukht and Heeks (2017:17): "That part of economic output derived solely or primarily from digital technologies with a business model based on digital goods or services".

Another approach is to view the digital economy as encompassing all the ways in which digital technologies are diffusing into the economy (Brynjolfsson and Kahin, 2002). Knichrehm et al. (2016: 2) define the foundations of the digital economy in broader terms, suggesting that it is: "The share of total economic output derived from a number of broad "digital" inputs. These digital inputs include digital skills, digital equipment (hardware, software and communications equipment) and the intermediate digital goods and services used in production. Such broad measures reflect the foundations of the digital economy".

Given the focus on value creation and capture in this Report, emphasis is given to the processes and changes in the digital (or overall) economy, rather than to the outcomes of activities. This has implications for the types of policies needed in relation to how the digital economy operates (and less on the requisite conditions for the emergence of such an economy). While it is necessary to pay attention to specific technologies, a focus on broader trends, such as platformization, digital data and e-commerce, is also needed. This enables an analysis of changes in the digital economy while acknowledging that such changes might happen in different ways. The above definitions highlight the varying emphases: either towards cutting-edge activities in the digital sector or the broader digitalization of the economy. Thus, the representation of the digital economy in this Report follows that used in UNCTAD (2017a), which is reproduced in figure I.1.

It should be noted that in discussions about the dynamic digital economy, reference is frequently made to "digital infrastructure", a concept that still lacks a widely accepted definition. It may be useful to consider different levels of digital infrastructure: (i) ICT networks (the core digital infrastructure for connectivity); (ii) data infrastructure (data centres, submarine cables and cloud infrastructure); (iii) digital platforms; and (iv) digital devices and applications. Some experts also include the data themselves as part of the digital infrastructure.[8] In the case of digital platforms, while they are not strictly infrastructure (they can also be agents participating in the activity that takes place on them), they also perform infrastructure-like functions by connecting two or more sides of a market. Moreover, at a zero level, electricity infrastructure is

Figure I.1. A representation of the digital economy



Source: Bukht and Heeks, 2017: 13.

essential to enable the use of digital infrastructure, as these technologies need power to run. In this Report, this broad and flexible approach is applied to the use of the term, digital infrastructure, depending on the context.

C. TRENDS IN EMERGING DIGITAL TECHNOLOGIES

The evolution of the digital economy is closely associated with progress in several frontier technologies, including some key software-oriented technologies, such as blockchain, data analytics and AI. Other emerging technologies range from user-facing devices (such as computers and smartphones) to 3D printers and wearables, as well as specialized machine-oriented hardware, such as IoT, automation, robotics and cloud computing. Rapid advances in these increasingly converging technologies have been enabled by a surge in capacity – as well as considerable cost reductions – of data storage, processing and transmission.

Detailed descriptions and analyses of each of these technologies have been extensively presented elsewhere.[9] This section focuses on some recent trends and prospects for these technologies and their geographical evolution, in order to provide an indication of the relative position of developing countries in the evolving digital technology landscape.

1. Blockchain technologies

Blockchain technologies are a form of distributed ledger technologies that allow multiple parties to engage in secure, trusted transactions without any intermediary. It is best known as the technology behind cryptocurrencies, but it is also of relevance for many other domains of importance to developing countries. These include digital identification, property rights and aid disbursement. Open-source platforms, such as Ethereum, allow programmers to develop decentralized applications to run on their blockchain. However, one challenge for blockchains is that, for some applications, they require a substantial, reliable electricity supply for processing.[10] Some blockchain applications are already in use in developing countries, for example in the areas of fintech, land management, transport, health and education in Africa (UNECA, 2017).

According to Gartner's blockchain business value forecast, after the first phase of a few high-profile successes in 2018–2021, there will be larger, focused investments and many more successful models in 2022–2026. And these are expected to explode in 2027–2030, reaching more than $3 trillion globally (WTO, 2018). Currently, China alone accounts for nearly 50 per cent of all patent applications for technology families relating to blockchains, and, together with the United States, they represent more than 75 per cent of all such patent applications (ACS, 2018).

2. Three-dimensional printing

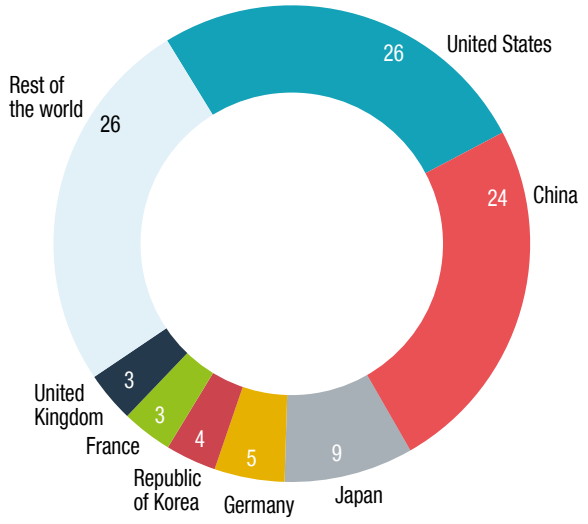
Three-dimensional (3D) printing, also known as additive manufacturing, can potentially disrupt manufacturing processes by boosting international trade in designs rather than in finished products. It offers opportunities for developing countries to leapfrog traditional manufacturing processes. Indeed, a number of 3D-printing ventures can already be found in some developing countries. For example, in Africa, such ventures exist for local entrepreneurship in Togo, for medical supplies in Uganda, for filling import gaps in Nigeria, for commercial ventures in South Africa and for renewable energy in Rwanda (Atlantic Council,

2018). India's largest bicycle and scooter maker has been using 3D printing since 2014, allowing products to reach markets at faster rates; and 3D printers are being used to create prosthetics in countries such as Cambodia, the Sudan, Uganda and the United Republic of Tanzania.[11] But 3D-printing capacity remains highly concentrated. In fact, the five leading countries (the United States, followed by China, Japan, Germany and the United Kingdom) account for an estimated 70 per cent of the total.[12]

3. Internet of things

Internet of things (IoT) refers to the growing array of Internet-connected devices such as sensors, meters, radio frequency identification (RFID) chips and other gadgets that are embedded in various everyday objects enabling them to send and receive various kinds of data. It has wide applications, including in energy meters, for RFID tagging of goods for manufacturing, livestock and logistics, for monitoring soil and weather conditions in agriculture, and for wearables. In 2018, there were more "things" (8.6 billion) connected to the Internet than people (5.7 billion mobile broadband subscriptions), and the number of IoT connections are forecast to grow at 17 per cent a year, to exceed 22 billion by 2024 (Ericsson, 2018). The top seven countries (the United States, followed by China, Japan, Germany, Republic of Korea, France and the United Kingdom) account for nearly 75 per cent of worldwide spending on IoT, with the first two countries representing 50 per cent of global spending (figure I.2).

Figure I.2. Geographical distribution of spending on Internet of things, 2019
(Per cent)



Source: UNCTAD, based on IDC, 2019.

The global IoT market is expected to grow tenfold, from $151 billion in 2018 to $1,567 billion by 2025 (IoT Analytics, 2018). IDC (2018) estimates that by 2025, an average connected person in the world will interact with IoT devices nearly 4,900 times per day, or the equivalent of one interaction every 18 seconds. This represents an exponential increase in comparison to 298 times per day in 2010 and 584 in 2015. Such rapid growth in the use of IoT will generate a further expansion of digital data.

4. 5G mobile broadband

Fifth generation (5G) wireless technology is expected to be critical for IoT due to its greater ability to handle massive volumes of data. 5G networks can process around 1,000 times more data than today's systems (Afolabi et al., 2018). In particular, it offers the possibility to connect many more devices (e.g. sensors and smart devices). While 72 mobile operators were testing 5G in 2018, 25 of them are expected to launch the service in 2019, and another 26 in 2020 (Deloitte, 2019). It is estimated that by 2025, the United States, followed by Europe and Asia Pacific will be leaders in 5G adoption. In order for developing countries to maximize the impact of IoT, significant investments in 5G infrastructure will be required. By 2025, the share of 5G in total connections is expected to reach 59 per cent in the Republic of Korea, compared with only 8 per cent in Latin America and 3 per cent in sub-Saharan Africa (table I.1). Moreover, the deployment of 5G may further increase the urban-rural digital divide, as setting up 5G networks in rural areas with lower demand will be commercially challenging (ITU, 2018a).

5. Cloud computing

Cloud computing is enabled by higher Internet speeds, which have drastically reduced latency between users and far away data centres. Data storage costs have also plummeted. The cloud is transforming business models, as it reduces the need for in-house IT expertise, offers flexibility for scaling, and consistent applications rollout and maintenance (UNCTAD, 2013). Some free cloud services provide office-like application tools that are useful for micro, small and medium-sized enterprises (MSMEs). This is particularly useful for countries where the cost of licensed software can be an obstacle to creating applications and providing

Table I.1. Mobile technology mix, by generation and region, 2018 and 2025
(Per cent)

	2018			2025			
	2G	3G	4G	2G	3G	4G	5G
Asia Pacific	34	21	45	5	13	67	15
Latin America	26	39	35	5	21	65	8
Middle East and North Africa	37	40	23	10	32	52	6
Sub-Saharan Africa	59	35	6	14	59	24	3
CIS	36	45	19	2	18	68	12
Europe	18	36	46	1	7	63	29
North America	9	21	69	2	7	44	47
World	29	28	43	5	20	59	15

Source: UNCTAD, based on GSMA, 2019.
Note: CIS – Commonwealth of Independent States. Country groups are those of the source.

services. However, in many developing countries, high costs of additional international bandwidth to access overseas servers and data centres still limit the uptake of cloud services.

Most cloud traffic is generated in North America, followed by Asia Pacific and Western Europe, which together account for about 90 per cent of all cloud traffic (figure I.3). From 2016 to 2021, the fastest annual growth rate in cloud traffic is expected to occur in the Middle East and Africa, at 35 per cent, followed by Central and Eastern Europe and Asia Pacific, each with a growth rate of 29 per cent. The cloud market is also highly concentrated. According to Synergy Research Group (2019), the share of the top five providers – Amazon Web Services (AWS), Microsoft, Google, IBM and Alibaba – in the global cloud infrastructure services market exceeds 75 per cent, with AWS alone accounting for over a third of that market.

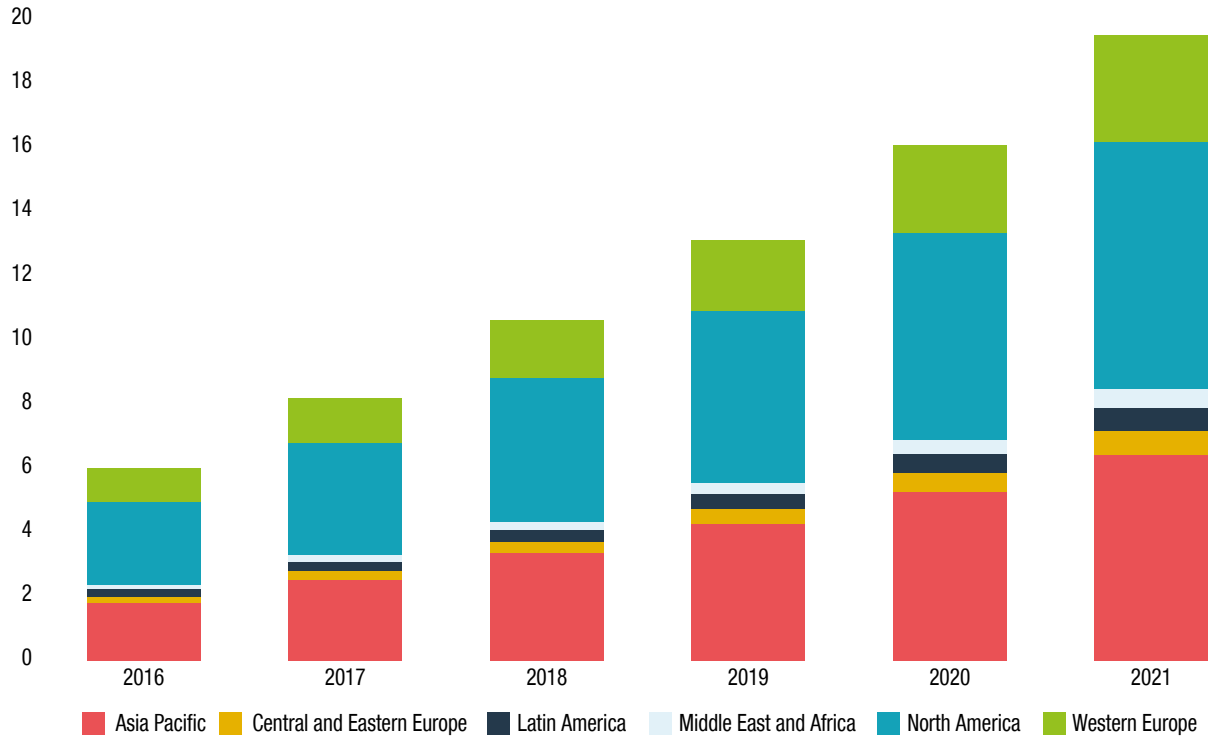
6. Automation and robotics

Automation and robotics technology are increasingly used in manufacturing, which could have significant impacts on employment. There are concerns that such technologies may constrain the scope for developing countries to adopt export-led manufacturing as a path to industrialization (UNCTAD, 2017c), and that the more developed economies may increasingly use robots to "reshore" manufacturing jobs. According to the International Federation of Robotics (2018), global sales of industrial robots doubled between 2013 and 2017. This trend seems set to continue, with sales expected to increase from 381,300 units in 2017 to 630,000 units by 2021. The top five markets (China, followed by Japan, the Republic of Korea, the United States and Germany) represented 73 per cent of the total sales volume of robots in 2017. China is showing the strongest demand, with a market share of 36 per cent. Robots are mainly used in the automotive, electrical/electronics and metal industries.

7. Artificial intelligence and data analytics

Developments in AI, including machine learning, are enabled by the large amounts of digital data that can be analysed to generate insights and predict behaviour using algorithms, as well as by advanced computer processing power. AI is already in use in areas such as voice recognition and commercial products (such as IBM's Watson). It has been estimated that this general-purpose technology has the potential to generate additional global economic output of around $13 trillion by 2030, contributing an additional 1.2 per cent to annual GDP growth (ITU, 2018b). At the same time, it may widen the technology gap between those that have and those that do not have the capabilities to take advantage of this technology. China and the United States are set to reap the largest economic gains from AI, while Africa and Latin America are likely to see the lowest gains.[13] China, the United States and Japan together

Figure I.3. Cloud traffic, by region, 2016–2021
(Zettabytes)



Source: UNCTAD, based on Cisco, 2018a.
Note: Country groups are those of the source.

account for 78 per cent of all AI patent filings in the world (WIPO, 2019).

Another related key technology in the digital economy is *data analytics*, sometimes dubbed as "big data".[14] This refers to the increasing capacity to analyse and process massive amounts of data. Indeed, the above technologies have one element in common, which is that they strongly rely on data. As will be seen in chapter II and throughout this Report, digital data are one of the core elements of value creation in the digital economy. Thus, the following section focuses on different variables related to data.

D. DATA TRAFFIC AND DATA CENTRES

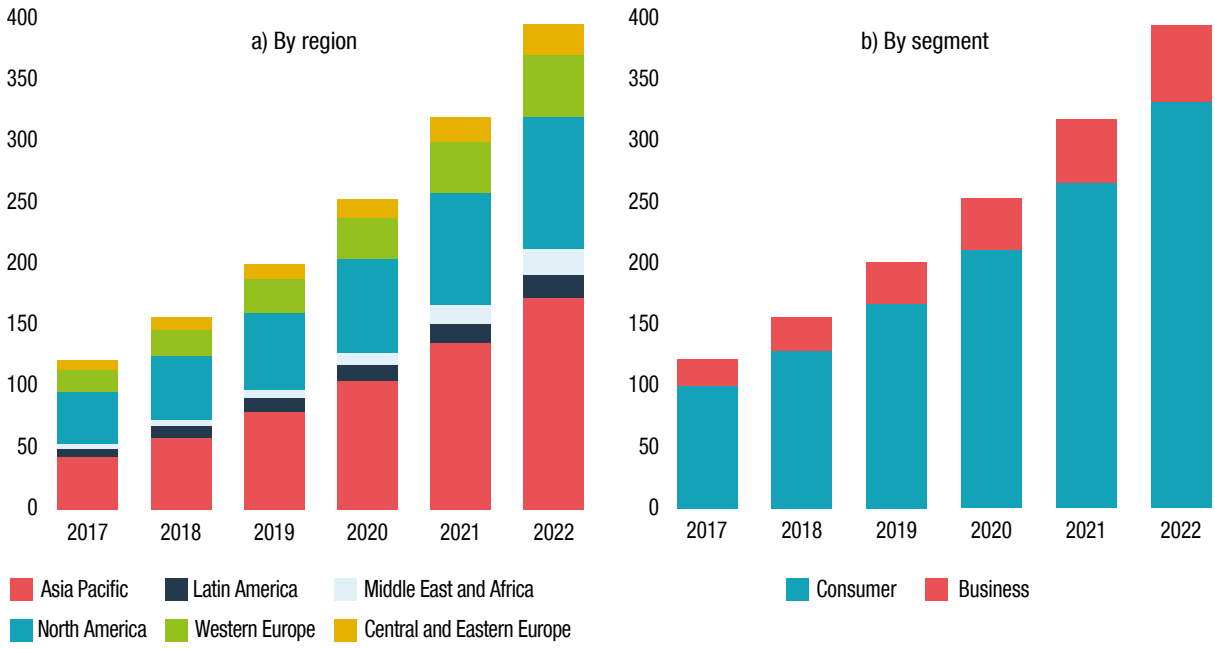
The amount of data generated in the evolving digital economy is constantly and rapidly increasing. Indeed, estimates provided by private companies are mind boggling. A white paper by IBM on Marketing Trends for 2017 noted that 2.5 quintillion bytes of data are created every day. It added: "To put that into perspective, 90 percent of the data in the world today has been created in the last two years alone".[15]

Global Internet Protocol (IP) traffic, a proxy for data flows, has grown dramatically in the past two decades. In 1992, global Internet networks carried approximately 100 gigabytes (GB) of traffic *per day*. Ten years later, it reached 100 GB *per second*. Fast-forward to 2017, and such traffic had surged to more than 46,600 GB per second, reflecting both qualitative and quantitative changes in the content. But despite the rapid growth to date, the world is only in the early stages of the data-driven economy: by 2022 global IP traffic is projected to reach 150,700 GB per second (figure I.4).

Figure I.4. Evolution of global Internet Protocol traffic
(Selected years)

Source: UNCTAD, based on Cisco, 2018b.

Figure I.5. Internet Protocol traffic, 2017–2022
(Exabytes per month)



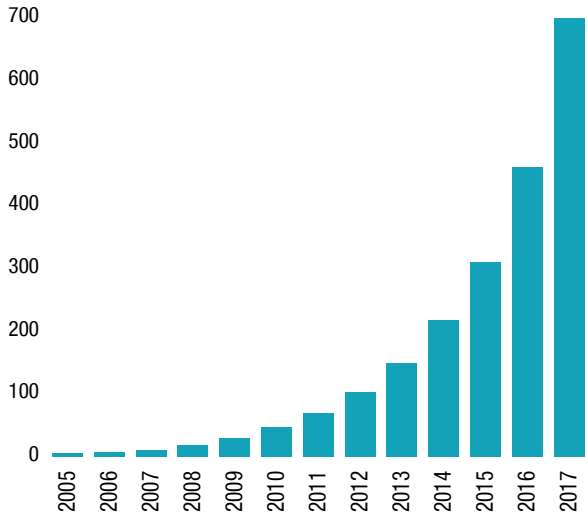
Source: UNCTAD, based on Cisco, 2018b.
Note: Country groups are those of the source.

Data traffic is highly concentrated: Asia Pacific and North America are the two regions that are expected to account for about 70 per cent of all traffic over the period 2017–2022. By contrast, Latin America, the Middle East and Africa together are expected to represent only around 10 per cent of global IP traffic (figure I.5a). However, the highest growth is forecast to occur in the Middle East and Africa, at 41 per cent per year, followed by Asia Pacific at 32 per cent. Meanwhile, global annual growth is projected to reach 26 per cent. In terms of content, video is expected to account for some 80–90 per cent of global IP traffic during the same period. When considered by segment, consumers (households, university populations and Internet cafés) are forecast to account for more than 80 per cent of the total, with governments and businesses constituting the rest (figure I.5b).

Regarding cross-border data flows (CBDFs), McKinsey (2019) estimates that cross-border bandwidth between 2005 and 2017 surged from 5 terabits per second to 704 (figure I.6), and it is projected to approach 2,000 by 2021.[16]

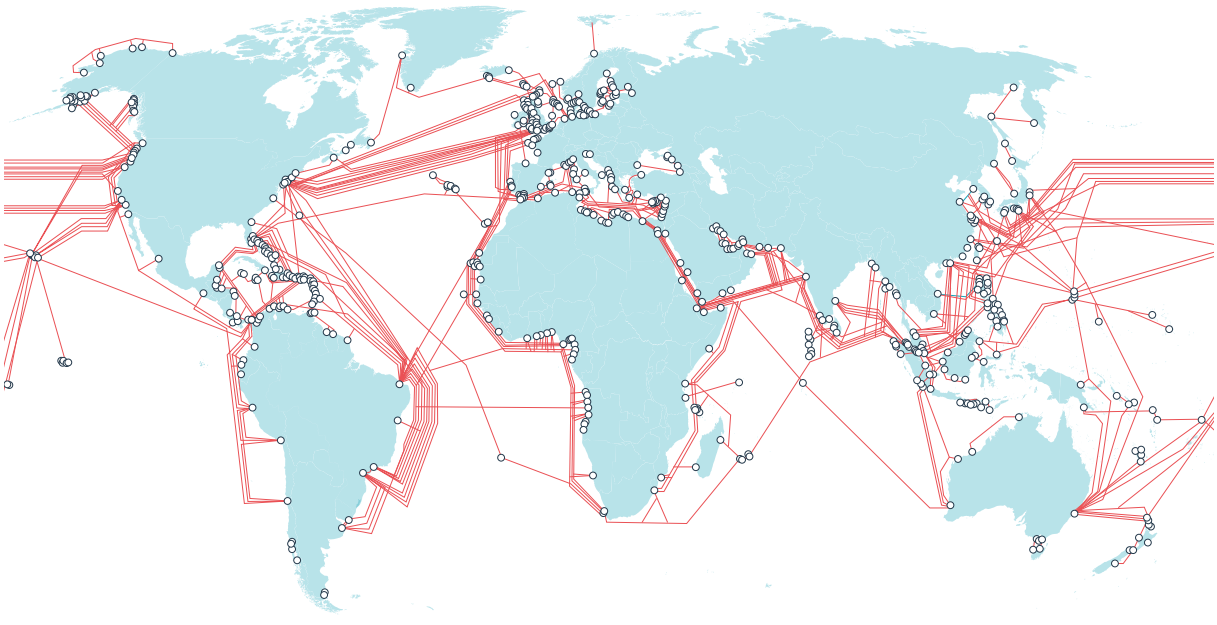
The increasing importance of data is leading to changes in the infrastructure for data transmission, notably an exponential increase in fibre optic submarine cables. Some 99 per cent of total international data transmissions run through these cables (Bischof et al., 2018). The world geography of submarine cable connections is shown in figure I.7. Big technology

Figure I.6. Global cross-border bandwidth, 2005–2017
(Terabits per second)



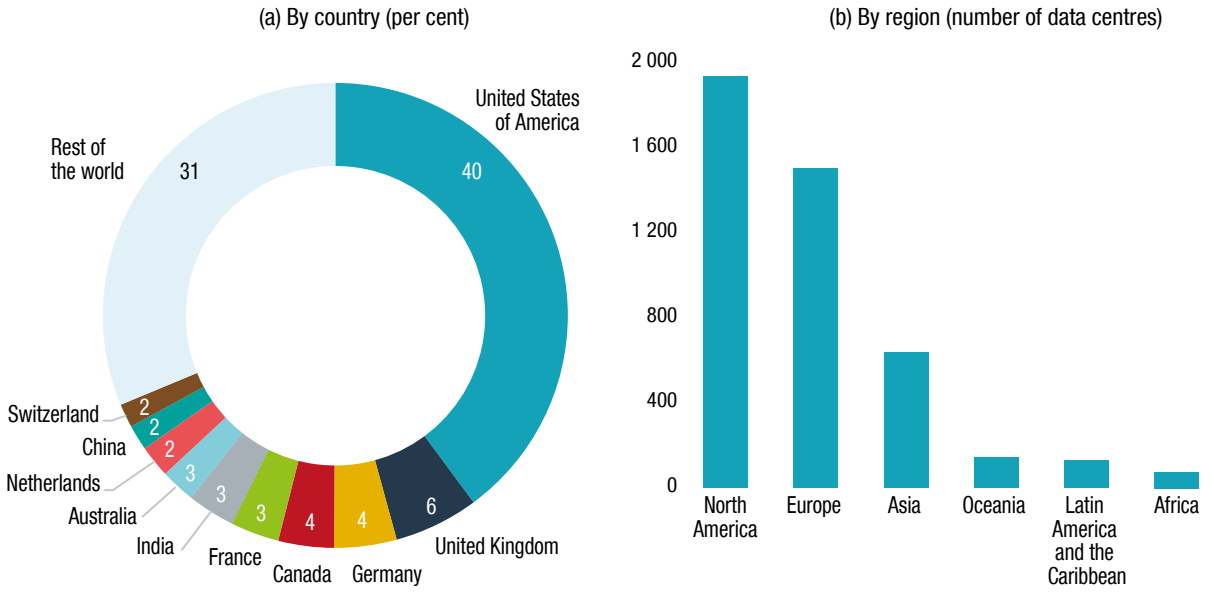
Source: McKinsey, 2019.

Figure I.7. Submarine cable map



Source: TeleGeography Submarine Cable Map (https://www.submarinecablemap.com/).

Figure I.8. Geographical distribution of colocation data centres, February 2019



Source: UNCTAD, based on Data Center Map (https://www.datacentermap.com/datacenters.html).

companies are increasingly investing in such cables. And content providers (such as Microsoft, Google, Facebook and Amazon) now own or lease more than half of all undersea bandwidth.[17]

The capacity for storage and processing of digital data is another aspect of infrastructure in the data-driven economy. Most data centres are located in developed countries. Out of a total of 4,422 so-called colocation data centres,[18] 80 per cent are in developed countries, with the United States accounting for about 40 per cent of the total (figure I.8).

Due to the large electricity requirements to cool the data centres, locations with cold climates, and abundant and reliable power supplies are the most attractive. Many developing countries find it difficult to compete for such centres due to high electricity costs. Nonetheless, more data centres are being set up in developing countries to keep data closer to the user, reduce latency and lower the costs of broadband use. As a result, traffic is increasing on Internet exchange points (IXPs) – locations where telecom carriers and providers of content come together to exchange IP traffic. However, as many as 78 economies still lack IXPs (World Bank, 2018a). Less than half of all the least developed countries (LDCs) have an IXP, and some of those that exist are not functioning to their full potential (ITU, 2018c).

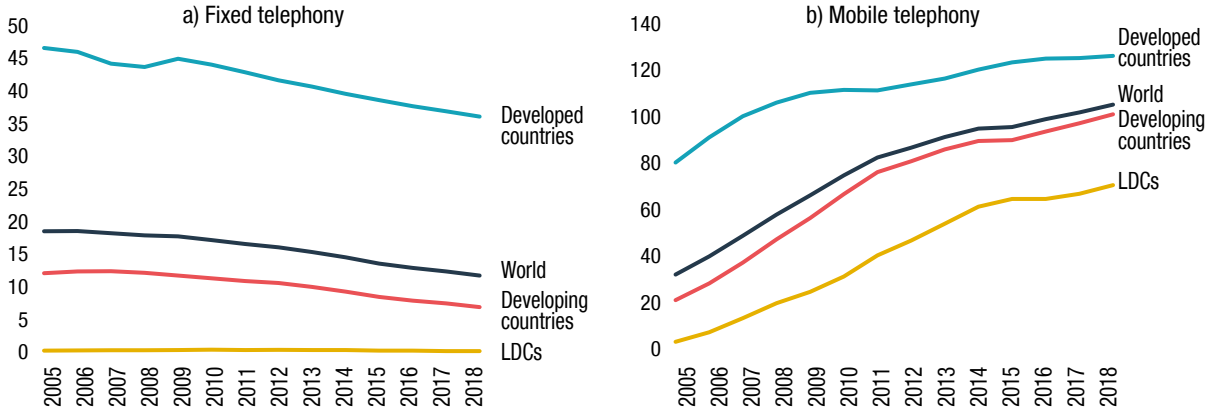
E. TRENDS IN ACCESS TO AND USE OF ICT

The availability of affordable ICT access is a pre-condition for any individual, firm or organization to use the emerging technologies discussed above, and to benefit from opportunities that they can provide. ICT infrastructure offers downstream benefits for businesses and consumers, as it can help the former become more productive and improve their access to markets. This section briefly reviews the latest trends in connectivity.

1. Trends in connectivity

Fixed telephony is being largely shunned by people in developing countries, where penetration was just 7.5 subscriptions per 100 people in 2018, down from 12.7 in 2005 (figure I.9a). Mobile telephony is increasingly substituting for voice and data traffic. While fixed telephone lines have been the precursor for updating to fast wired broadband (such as ADSL, cable modem and on to fibre optics), new generations of wireless technologies are offering the potential to close the gap in speed and latency. The International Telecommunication Union (ITU) estimates that mobile subscription penetration was 103 per 100 people in developing economies in 2018 – though there were significant

Figure I.9. Telephone subscriptions, global and by level of development, 2005–2018
(Per 100 people)



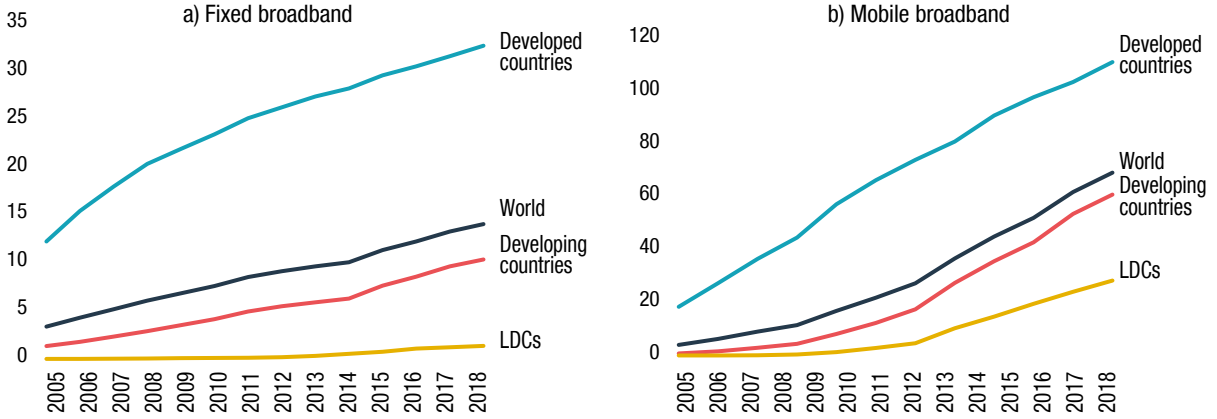
Source: UNCTAD, based on ITU Statistics database (https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx).

differences by region – compared with an average of 128 per 100 people in developed countries. In LDCs, penetration surged from 5 mobile subscriptions per 100 people in 2005 to 72 in 2018 (figure I.9b).

Growing from a very low base, fixed broadband subscriptions have remained low in developing countries, at just over 10 per 100 people in 2018, compared to 32.7 in developed countries (figure I.10 a). In contrast, mobile broadband subscriptions have risen rapidly, reaching nearly 111 active subscriptions per 100 people in 2018 in developed countries and 61 in developing countries (figure I.10 b).

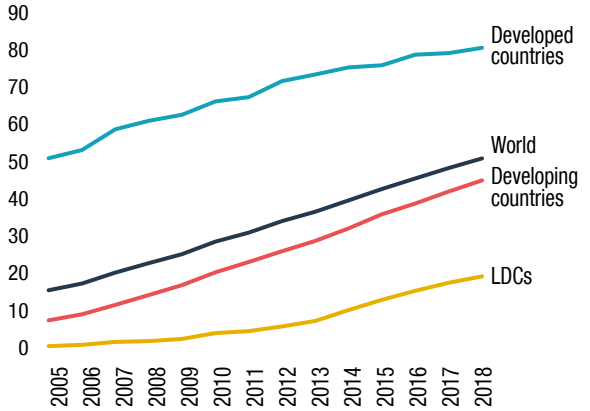
In 2018, the landmark of half (51.2 per cent) the global population using Internet was reached, with 3.9 billion people going online (ITU, 2018d). While this represents significant progress towards inclusiveness in the digital economy, significant Internet divides remain. In LDCs, for example, only one out of five people are online, compared with four out of five in developed countries. Most of the growth in Internet use is in developing countries, which account for around 90 per cent of the global increase, with the highest rate of growth in the LDCs (figure I.11). The growth in Internet use has slowed in recent years, suggesting there is still room for improvement in many low- and middle-income countries (LMICs). Limited Internet use is an impediment to scaling the market for value creation in the digital economy. The slowdown in the rate of growth of new people coming online is partly linked to their inability to afford a basic Internet connection and relevant devices. Overall, only in 40 per cent of the LMICs is there affordable Internet access. About 2.3 billion

Figure I.10. Broadband subscriptions, global and by level of development, 2005–2018
(Per 100 people)



Source: UNCTAD, based on ITU Statistics database (https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx).

Figure I.11. Internet use, global and by level of development, 2005–2018
(Per 100 people)



Source: UNCTAD, based on ITU Statistics database (https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx).

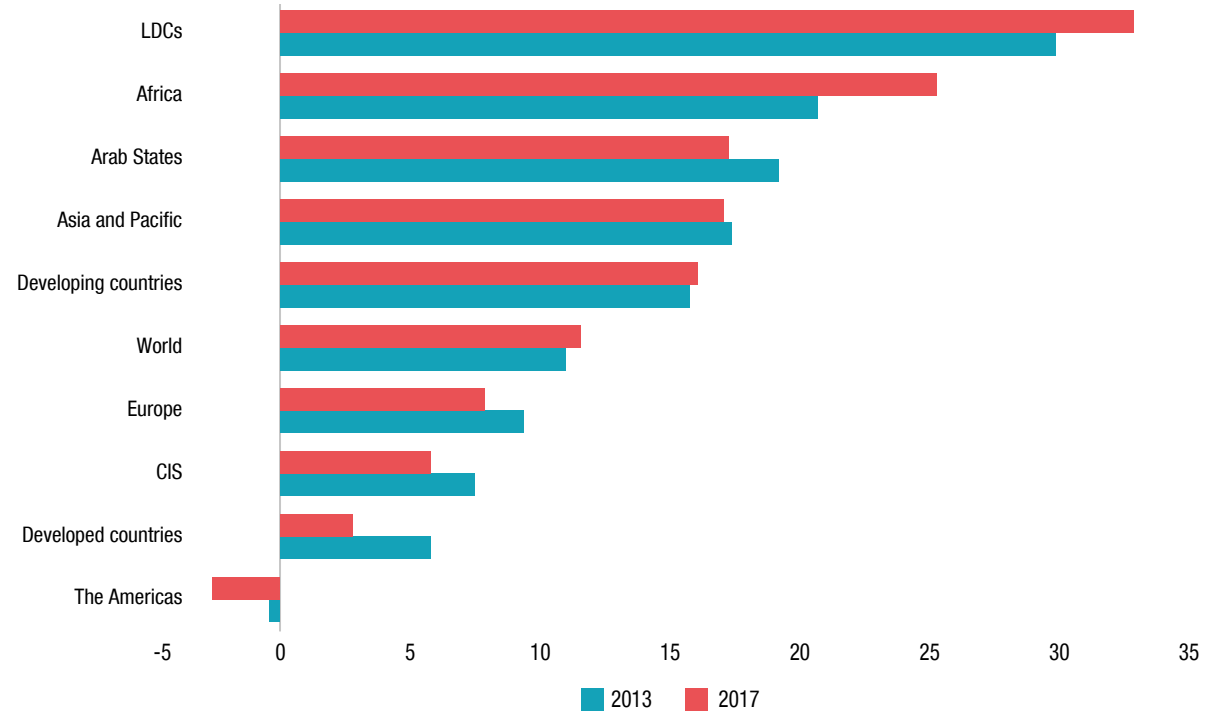
people in the world live in countries where 1-GB mobile broadband plans are unaffordable for individuals earning an average income. Among developing-country regions, Africa has the highest average costs of Internet access (Alliance for Affordable Internet, 2018).

2. Connectivity gaps within countries

Apart from cross-country differences in connectivity, there are also significant gaps within countries based on levels of income, education, gender and geographical location. For instance, there is still a considerable urban-rural divide. In LDCs, about 89 per cent of urban households have a mobile phone compared with only 63 per cent in rural ones (ITU, 2018c).

A gender divide is similarly evident (ITU, 2017). In two thirds of all countries, the proportion of women using the Internet is lower than that of men. The gender gap in Internet use – defined as the difference between male and female user penetration rates – is almost 11.6 per cent for the world, marginally up from 11 per cent in 2013. It is, on average, about 16.1 per cent in developing countries and only 2.8 per cent in developed countries. The highest gaps are observed for LDCs (32.9 per cent) and sub-Saharan Africa (25.3 per cent), where the gap actually widened between 2013 and 2017 (figure I.12).[19]

Figure I.12. Gender gap in Internet use, by level of development and region, 2013 and 2017
(Per cent)



Source: UNCTAD, based on ITU, 2017.
Note: Country groups are those of the source.

F. RECENT EVOLUTION OF E-COMMERCE

E-commerce is one of the components of the digital economy, as shown in figure I.1. It covers goods and services sold and bought online, including transactions via platform-based companies such as ride-hailing apps, reflected under business-to-consumer (B2C) revenue reported by the transportation sector, and room-sharing platforms reported under accommodation.

The global value of e-commerce is estimated by UNCTAD to have reached $29 trillion in 2017, which is equivalent to 36 per cent of GDP (table I.2). This corresponds to a 13 per cent growth from the previous year. The list of top 10 countries by total e-commerce sales has remained unchanged since 2016, with the United States being the market leader. Global business-to-business (B2B) e-commerce was $25.5 trillion in 2017, representing 87 per cent of all e-commerce, while B2C e-commerce was $3.9 trillion in 2017, an increase of 22 per cent over the previous year. The top three countries in B2C e-commerce sales were China, followed by the United States and the United Kingdom.

Cross-border B2C sales by value of merchandise exports amounted to an estimated $412 billion in 2017 (table I.3). This corresponds to almost 11 per cent of total B2C sales, up from 7 per cent in 2015.

E-commerce allows consumers to benefit from greater choices and lower prices. An estimated 1.3 billion people, or one quarter of the world's population aged 15 years and older, shopped online in 2017 (figure I.13). This is 12 per cent higher than in 2016. China has the largest number of online shoppers (440 million), whereas the United Kingdom has the highest proportion of online shoppers to the population (82 per cent of those aged 15 years and older). Uptake in low-income economies is considerably lower, suggesting that it takes more than wireless connectivity for e-commerce to take off (figure I.14).

Table I.2. E-commerce sales: Top 10 countries, 2017

Rank	Country	Total e-commerce sales	As a share of GDP	B2B	Share of total e-commerce	B2C	Annual average expenditure per online shopper ($)
		($ billion)	(per cent)	($ billion)	(per cent)	($ billion)	
1	United States	8 883	46	*8 129*	90	753	3 851
2	Japan	2 975	61	2 828	95	147	3 248
3	China	1 931	16	869	49	1 062	2 574
4	Germany	*1 503*	41	*1 414*	92	88	1 668
5	Rep. of Korea	*1 290*	84	*1 220*	95	69	2 983
6	United Kingdom	755	29	548	74	206	4 658
7	France	*734*	28	642	87	92	2 577
8	Canada	*512*	31	*452*	90	60	3 130
9	India	*400*	15	*369*	91	31	1 130
10	Italy	*333*	17	*310*	93	23	1 493
	Total of above	19 315	36	16 782	87	2 533	2 904
	World	29 367		25 516		3 851	

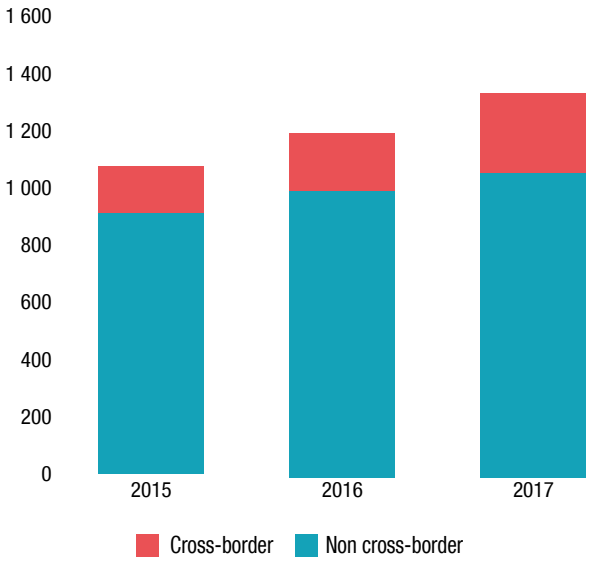
Source: UNCTAD.
Note: Figures in italics are UNCTAD estimates.

Table I.3. Estimated cross-border B2C sales: Top 10 merchandise exporters, 2017

Rank	Economy	Cross-border B2C sales ($ billion)	As a share of merchandise exports (per cent)	As a share of B2C sales (per cent)
1	United States	102	6.6	13.5
2	China	79	3.5	7.5
3	United Kingdom	31	7.0	15.0
4	Japan	18	2.6	12.2
5	Germany	15	1.0	17.1
6	France	10	1.8	10.6
7	Canada	8	1.8	12.7
8	Italy	4	0.7	16.2
9	Rep. of Korea	3	0.5	3.8
10	Netherlands	1	0.2	5.0
Total for top 10		270	3.0	10.7
World		412	2.3	10.7

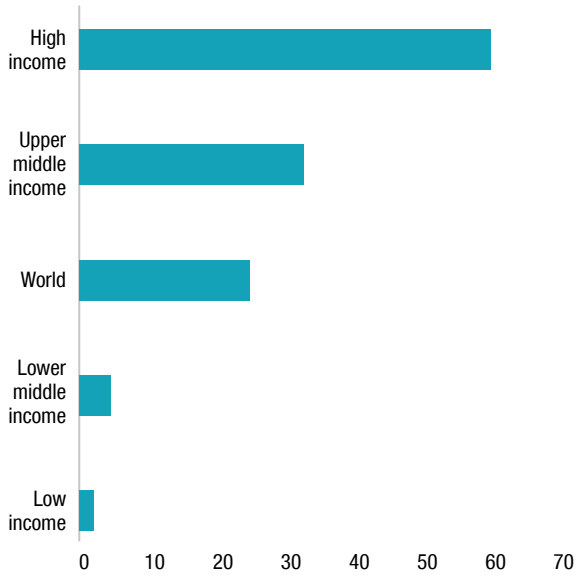
Source: UNCTAD.

Figure I.13. Global online shoppers, 2015–2017
(Million)



Source: UNCTAD.

Figure I.14. Use of Internet for online purchases, country groups by level of income, 2017
(Per cent of population aged 15 years or older)

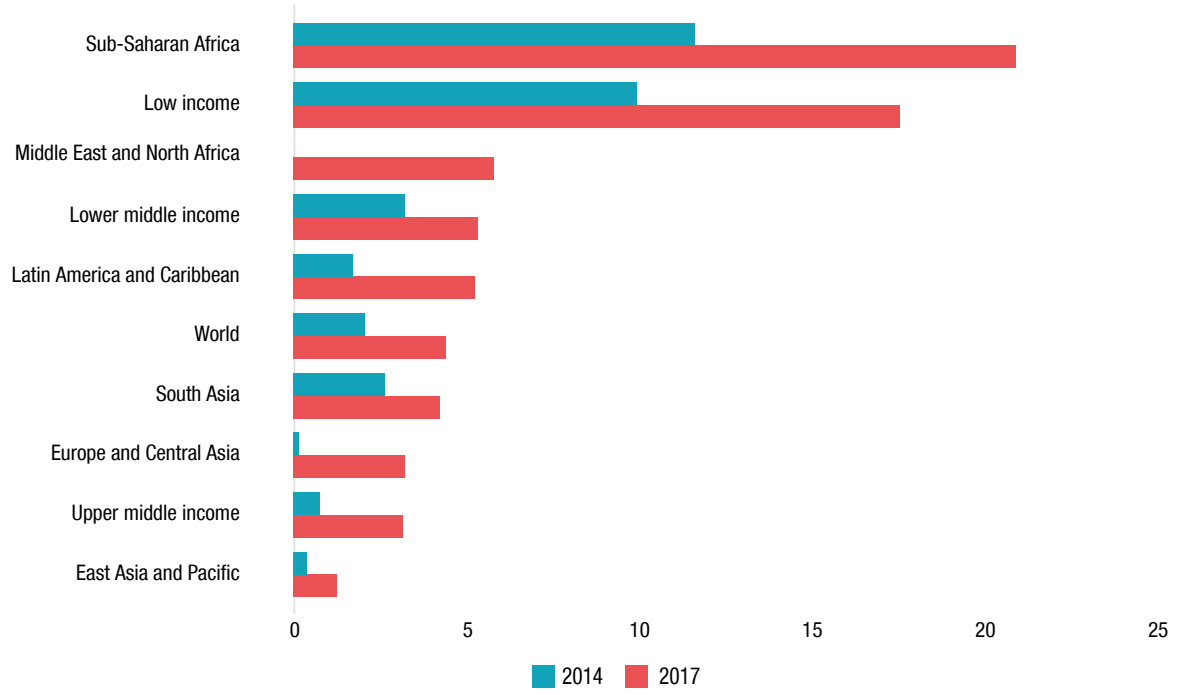


Source: UNCTAD, based on World Bank, *Global Financial Inclusion Database* (https://globalfindex.worldbank.org/#data_sec_focus).
Note: Country groups are those of the source.

While most online shoppers mainly buy from domestic suppliers, some 277 million people made a cross-border purchase in 2017, and interest in buying from foreign suppliers is growing. The share of cross-border online shoppers in total online shoppers rose from 15 per cent in 2015 to 21 per cent in 2017 (figure I.13). This growth was driven by a significant increase in United States shoppers buying from foreign suppliers.[20]

Mobile money has improved financial inclusion, making it easier, cheaper and safer to transfer money, as well as to pay for goods and services. This is notable in low-income countries, particularly in sub-Saharan Africa, where the share of the population aged 15 years and older having a mobile money account had surged to 21 per cent by 2017 – the highest share in the world (figure I.15).

Figure I.15. Mobile money accounts, by country group, 2017
(Per cent of population aged 15 years or older)



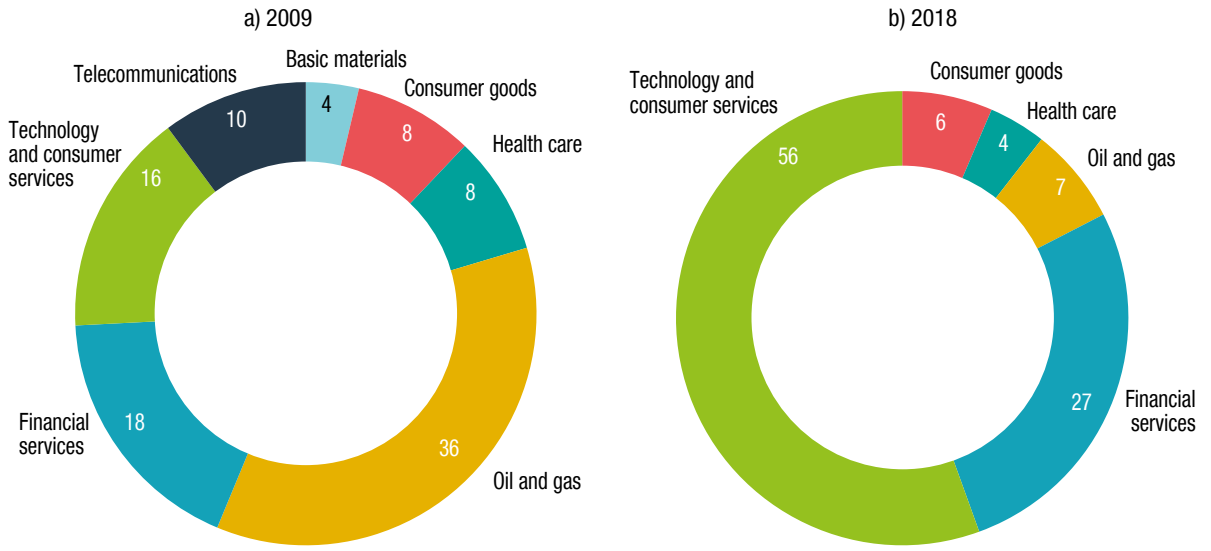
Source: UNCTAD, based on World Bank, *Global Financial Inclusion Database* (https://globalfindex.worldbank.org/#data_sec_focus).
Note: Country groups are those of the source.

G. THE RISE OF TECHNOLOGY COMPANIES IN THE GLOBAL BUSINESS LANDSCAPE

The transformational impact of digitalization becomes most evident when considering the growing importance of a few large technology companies and digital platforms over the past decade. A comparison of the composition, by sector, of the top 20 companies in the world by market capitalization shows a dramatic shift. In 2009, seven companies from the oil and gas and mining sector were among the top 20, accounting for 35 per cent of the total, whereas there were only three companies from the technology and consumer services sector, which includes digital platforms. Another three were from the financial sector. By 2018, the picture had changed significantly: the number of technology and consumer services companies in the top 20 had surged to eight (40 per cent), and that of financial companies to seven. By contrast, only two companies in oil and gas and mining remained among the top 20. Moreover, out of the top 10 companies in 2018, only two remained from those listed in 2009. Four of the top 10 firms in 2018 did not even feature among the top 100 in 2009: Amazon, Alibaba, Facebook and Tencent.

The shift is even more remarkable when measured in terms of market capitalization. In 2009, companies in the oil and gas sector accounted for 36 per cent of the total market capitalization of the top 20, followed by financial services with a share of 18 per cent, while technology and consumer services represented 16 per cent. By 2018 the share of the latter had increased to 56 per cent and that of financial services had risen to 27 per cent. By contrast, the share of oil and gas companies in total market capitalization significantly declined to just 7 per cent over the same period (figure I.16).

Figure I.16. World's top 20 companies by market capitalization, by sector, 2009 versus 2018
(Per cent)

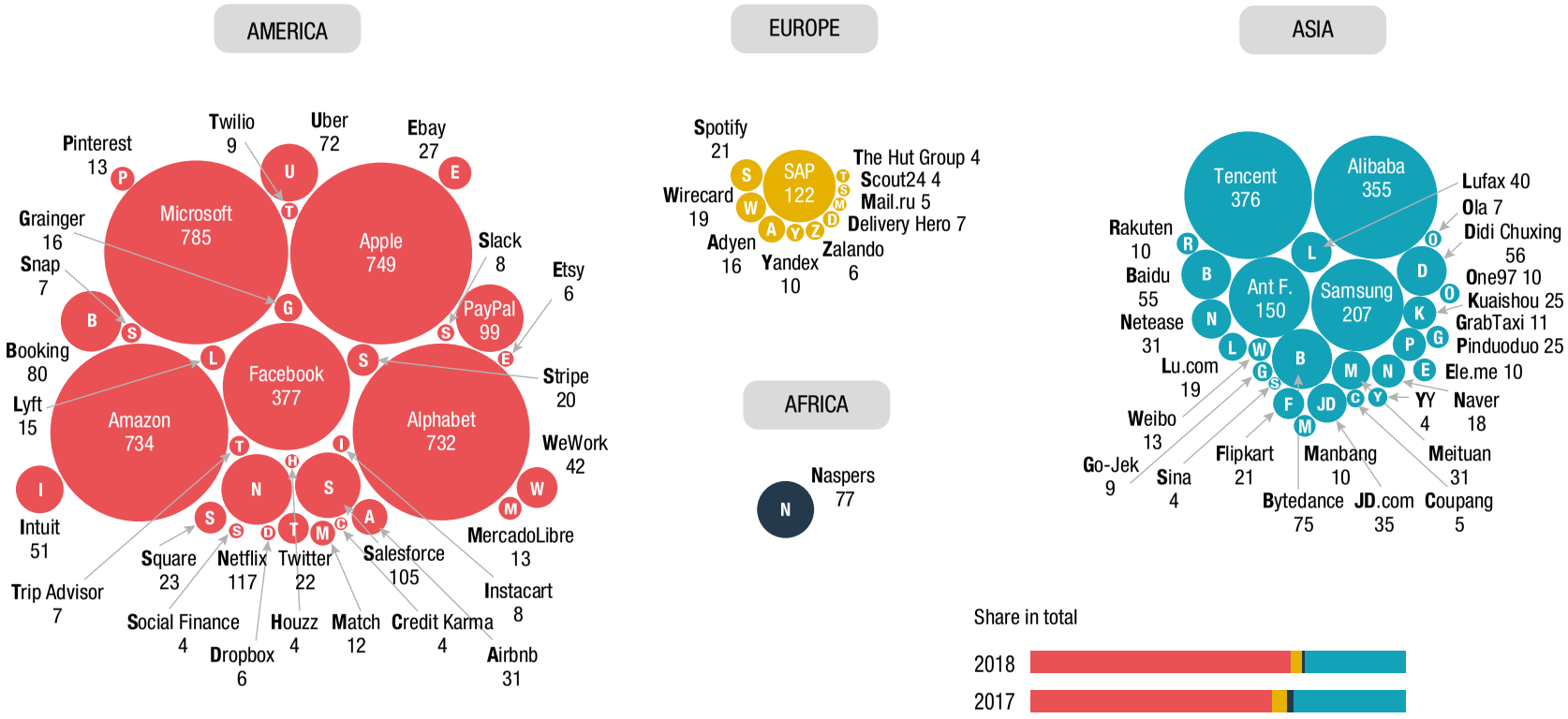


Source: UNCTAD, based on PwC, 2018b.

The world's top digital firms are highly concentrated geographically (figure I.17). Among the world's 70 highest valued digital platforms, most are based in the United States, followed by Asia (especially China). Latin American and African digital platforms are only marginal. In terms of market capitalization value, digital platform companies from the United States increased their share in the global total from 65 per cent to 70 per cent (see also chapter IV).[21]

An analysis of web traffic data confirms the dominance of the large United States digital platform companies (table I.4). The United States hosts more than half of the top 100 websites used in 9 of the world's 13 subregions shown in the table. Even in Western Europe, the most-used websites are based in the United States.

Figure I.17. Geographical distribution of the main global platforms in the world, 2018
(Market capitalization in billions of dollars)



Source: Holger Schmidt (https://www.netzoekonom.de/vortraege/#tab-id-1).

Table I.4. Distribution of the top 100 websites by region
(Per cent)

	Requested web site location												
Requesting Location	Caribbean-Atlantic	Central America	Central Asia	East Asia	Eastern Europe	South America	US-Canada	Western Europe	Middle East	South Asia	North Africa	Sub-Saharan Africa	Oceania
Caribbean-Atlantic	4.2	0.0	0.0	1.9	0.9	0.5	76.7	15.8	0.0	0.0	0.0	0.0	0.0
Central America	0.0	4.3	0.0	1.0	0.0	1.4	78.1	15.2	0.0	0.0	0.0	0.0	0.0
Central Asia	0.0	0.7	16.4	0.0	22.4	0.0	36.8	23.0	0.7	0.0	0.0	0.0	0.0
East Asia	0.0	0.0	0.0	42.0	1.5	0.4	49.5	6.4	0.0	0.0	0.0	0.0	0.2
Eastern Europe	0.0	0.0	0.1	0.0	40.6	0.0	41.4	17.9	0.0	0.0	0.0	0.0	0.0
South America	0.0	0.0	0.0	0.5	0.0	13.6	71.8	14.1	0.0	0.0	0.0	0.0	0.0
US-Canada	0.0	0.0	0.0	4.0	0.0	1.6	74.2	20.2	0.0	0.0	0.0	0.0	0.0
Western Europe	0.0	0.1	0.0	1.7	2.9	0.9	49.1	45.3	0.0	0.0	0.0	0.0	0.0
Middle East	0.0	0.0	0.0	1.7	1.6	0.5	60.3	21.6	13.5	0.8	0.0	0.0	0.0
South Asia	0.0	0.0	0.0	6.2	0.8	0.0	66.9	17.3	0.0	8.8	0.0	0.0	0.0
North Africa	0.0	0.0	0.0	0.7	0.7	0.0	75.3	22.7	0.0	0.0	0.7	0.0	0.0
Sub-Saharan Africa	0.0	0.0	0.0	1.4	1.4	0.4	59.7	28.1	0.0	0.5	0.0	8.6	0.0
Oceania	0.0	0.0	0.0	3.4	0.0	1.7	62.4	14.5	0.0	0.0	0.0	0.0	17.9

Source: Mueller and Grindal, 2018.
Note: Country groups are those of the source.

H. CONCLUSIONS

Although there is no universally agreed definition of the digital economy, this chapter has identified some of its key components. It has also highlighted the growing importance of digital data and a number of emerging technologies. Understanding this context is essential for the analysis of possible implications for value creation and capture in the digital economy.

The review of recent trends in emerging digital technologies points to a very high level of geographical concentration in almost all aspects of the digital economy and digital infrastructure. In particular, more than in other sectors, digital technologies and digital platforms are closely linked to two countries: the United States and China. For example, these two economies account for 75 per cent of all patents related to blockchain technologies, 50 per cent of global spending on IoT, at least 75 per cent of the cloud computing market, and for 90 per cent of the market capitalization value of the world's 70 largest digital platform companies. The United States alone also hosts 40 per cent of the world's colocation centres. Thus, these two economies are playing the leading role in digital technological developments in the world, while Africa and Latin America, in particular, are trailing far behind.

Although improving, the traditional dimension of the digital divide in terms of digital connectivity and readiness to benefit from the digital economy is still of concern in many developing countries, especially the LDCs. The current trends of new technologies being concentrated in a few countries and controlled by relatively few companies have implications for the ability of both developing and developed countries to participate in the technological learning processes needed to catch up and thrive in the digital economy.

The context provided in this chapter serves as the foundation for the remainder of the report. Chapter II examines the notion of value in the digital economy, and provides a conceptual basis for discussion, especially around the two main drivers of the evolving digital economy: digital data and platformization.

Chapter III examines the scope and challenges for measuring value in the digital economy, and highlights the need for improving the collection and analysis of relevant statistics. Due to the paucity of statistics relating to this area, the chapter takes a pragmatic approach, using available information to measure value specifically in the ICT sector – a core element of the digital economy. It also highlights some recent attempts at measuring value added in e-commerce, spillover effects from the digital economy and value in the data-driven economy.

Chapter IV considers some of the systemic dynamics of digitalization at the global level, and their possible implications for value creation and capture, especially in developing countries. In particular, it delves into aspects related to the growing role and market power of some global digital platforms, and examines issues relating to data, employment and labour, as well as taxation.

Chapter V discusses the current situation in developing countries in terms of domestic value creation and capture in the digital economy, and seeks to identify areas offering the greatest opportunities.

Finally, chapter VI is devoted to relevant policy challenges. It discusses what could be done both at national and international levels to help ensure that digitalization brings benefits to all, and not only to the few. It identifies key policy areas for governments to consider, which would help improve the ability of their firms to engage beneficially in the digital economy, as well as to ensure that they capture a fair share of the value created in their economies. It also discusses areas where action is needed at the international level, including competition, taxation and employment. In addition, it underlines the need for clearer strategies related to "digital for development" by public and private providers of development assistance aimed at narrowing the digital divide and securing a more inclusive digital economy.

Notes

1 See, for instance, UNCTAD, 2017a; World Bank, 2016; Graham et al., 2017; Manyika et al., 2014; and Ojanperä et al., 2016.

2 For example, UNCTAD's series of country reports titled *Rapid eTrade Readiness Assessment of Least Developed Countries* provide a basic analysis of the current e-commerce situation in each of the countries they cover in order to identify opportunities and barriers. They can be accessed at: https://unctad.org/en/Pages/Publications/E-Trade-Readiness-Assessment.aspx.

3 *Digitalization*, which covers the broader implications of the growth of digital technologies, is seen as separate from the underlying technical processes of *digitization* by which information is converted from analog to digital flows (see Brennen and Kreiss, 2014).

4 For example, there have been fewer studies relating to mobile payments, new modes of mobile finance and e-commerce in the digital economy, even though these are arguably at the forefront of the growth of the digital economy in developing countries (exceptions include Dahlman et al., 2016; and UNEP, 2014).

5 Adapted from Bukht and Heeks, 2017; Malecki and Moriset, 2007; and UNCTAD, 2017a. There is an ongoing debate about which firms in specific sectors or categories should be included or excluded as digital or IT. For example, gaming, digital media and financial services firms, which might arguably be seen as key firms in the digital economy, have not been included in some of the measurements (HoC, 2016).

6 For example, surveys on Internet-enabled trade and use of e-commerce data offer some indications of the extent and impacts of digitalization. However, they often only provide ballpark figures, while accessing data remains difficult.

7 It should be noted that many of these studies acknowledge that determining what should or should not be included within this definition is often "fuzzy", and need not necessarily exclude some exploration of broader digitally enabled activities. However, these aspects are typically considered secondary.

8 See World Bank, 2018a; and Open Data Institute, 2018a.

9 See, for instance, UNCTAD, 2017a and 2018a.

10 For example, in Georgia, the mining of cryptocurrencies has had a major impact on electricity consumption, turning the country from a net exporter of electricity to a net importer (World Bank, 2018c).

11 See: *The Economic Times*, 18 February 2015, Hero MotoCorp powers ahead with 3D printing; and *The Guardian*, 19 February 2017, 3D-printed prosthetic limbs: The next revolution in medicine.

12 HP and ATKearney (2018), citing Wohler´s Report, 2017.

13 See PwC, 2018a.

14 There seems to be a tendency to avoid using the term "big data". Data are just data, be they big or small. Moreover, big data is not a technology. Technological progress is associated with the capacity to analyse massive amounts of data through powerful algorithms. Thus, it may be more appropriate, as in this Report, to use the term "data analytics".

15 See, IBM, 2017, 10 key marketing trends for 2017 and ideas for exceeding customer expectations. Available at: https://www.ibm.com/downloads/cas/XKBEABLN.

16 See: https://www.theatlas.com/charts/rJvTuVL0e.

17 See *New York Times*, 10 March 2019, How the Internet travels across oceans.

18 Colocation data centres are understood to be facilities in which space for servers and other computing hardware can be rented. Such centres typically provide cooling, power, bandwidth and physical security, while the customer provides servers and storage.

19 For a detailed analysis on gender digital divides, see Equals Research Group, 2019.

20 See *UNCTAD press release*, 29 March 2019, Global e-commerce sales surged to $29 trillion, at: https://unctad.org/en/pages/newsdetails.aspx?OriginalVersionID=2034&Sitemap_x0020_Taxonomy=UNCTAD%20Home;#2258;#UNCTAD%20E-Week%202019.

21 Another study confirms that North American and Asian platforms account for about 97 per cent of the total value of platform companies (see: Dutch Transformation Forum, 2018).

The implications of digital disruptions for the creation and capture of value in developing countries are becoming increasingly important to understand. This involves shifting the focus beyond issues related to access and use of ICTs to the production side, to enable an assessment of the overall impacts on structural change, growth and development. This chapter discusses conceptually the process of value creation and capture from the perspective of sustainable development. It examines how new forms of value can be created, particularly around digital platforms and data; but it also points to possible risks posed by new business models for countries, firms and individuals that are less prepared to take advantage of new technologies. The proposed conceptual framework highlights four elements: the division of value, governance of value, upgrading and value creation versus capture.

VALUE IN THE DIGITAL ECONOMY

2

VALUE IN THE DIGITAL ECONOMY

How to create value from digital data?

Digital data are an increasingly valuable economic resource, but only once they are transformed into digital intelligence that can be monetized.

Usage and consumption

Policy focus shift

to create and capture **more value**

Production and innovation

Structural transformation bringing Wealth creation

Fair distribution?

Data value chain

Transform data into **digital intelligence**

Analyse

Store

Collect

From **Data** to **Value** creation

Data Monetization

Selling targeted online advertising (e.g. Google, Facebook)

Operating e-commerce platforms (Amazon, Alibaba, Uber, Airbnb)

Transforming traditio-nal goods into rentable services (Mobike, Rolls Royce)

Renting out cloud services (Amazon Web Services, Tencent, MyJohnDeere)

Four dimensions to consider

- Distribution of value
- Scope for upgrading
- Governance of value creation
- Value creation vs. capture

Different actors to consider

Assessing the scope for value creation needs to consider the **possible impacts** on different **actors:**

- Individuals
- Small and large businesses
- Governments
- Economy-wide effects

Digital disruption opens both opportunities and challenges for developing countries. The net impact depends on the level of development and readiness of countries and their stakeholders. Policies adopted and enforced are key to influence the outcome.

A. DRIVERS OF VALUE CREATION IN THE DIGITAL ECONOMY

Economic value traditionally has been closely associated with the production of goods and services. Key issues in defining economic value relate to the ways in which outputs are produced (production) and shared across the economy (distribution) as well as what is done with the earnings from this production (reinvestment). It is the productive transformation of raw materials into goods and services that creates wealth, which potentially can be distributed across society (Mazzucato, 2018a). In this context, the major actors in the economy are producers, consumers and the government, while the main objective is the production of goods and services. Production is based on different resources, such as labour, and different forms of capital, both physical and human.

In the new business models of the digital economy, two emerging and related forces are increasingly driving value creation: platformization and the monetization of the rapidly expanding volume of digital data. Digital platforms are central actors in this economy, and digital data have become a key resource in economic processes, which can lead to value creation. Their interaction has a significant impact on the capture of the value created. Given that the digital economy is only beginning to emerge in most developing countries, there is limited evidence of its effects on value creation and distribution. It is important to identify the ways in which firms can create value, and the means of addressing obstacles to such processes. This enables an understanding of the potential for the creation and distribution of value, paths for upgrading, governance of value and forms of value capture.

This section discusses the two fundamental elements through which digitalization is changing the functioning of the economy: digital platforms and digital data. The analysis should be considered mainly as a stepping stone towards developing an enhanced understanding of how value may be created and captured in the digital economy.

1. Digital platforms

The concept of "platform" is not new. It refers essentially to mechanisms that bring together a set of parties to interact. Parker et al. (2016: 11) define it as "…a business based on enabling value-creating interactions between external producers and consumers. The platform provides an open, participative infrastructure for these interactions and sets governance conditions for them".

Digital platforms offer these mechanisms online, and can be both intermediaries and infrastructures. They are intermediaries in that they connect different groups of people (the different "sides" of multi-sided markets).[22] For example, Facebook connects users, advertisers, developers, companies and others, and Uber connects riders and drivers. Many platforms also serve as infrastructures that different sides can build upon. For example, users can develop profile pages on Facebook, and software developers can build apps for Apple's App Store. In fact, any specific firm may itself be only partly a platform business. In the case of Apple, the vast majority of its activities focus on selling high-end consumer goods – a rather traditional business.

Platforms have been explored from a number of perspectives, reflecting their functionalities, scope (firm, sectoral or economy level), geographic focus and levels of openness (box II.1). An important distinction relates to their underlying operations, which may be divided into two key categories: transaction platforms and innovation platforms (Gawer, 2014; Koskinen et al., 2018; Parker et al., 2016).

Transaction platforms, which are sometimes referred to as two/multi-sided platforms or two/multi-sided markets, offer an infrastructure, typically an online resource, that supports exchanges between a number of different parties (Gawer, 2014). Transaction platforms are closely associated with transformations in the global digital economy, in which they have become a core business model for major digital corporations like Amazon, Alibaba, Facebook and eBay, as well as those that are supporting digitally enabled sectors, such as Uber, Didi Chuxing or Airbnb.

Innovation platforms are sometimes also referred to as engineering or technology platforms. This terminology highlights the way that firms, industries or sectors use "component and subsystem assets shared across a family of products" (Krishnan and Gupta, 2001: 52). At an *industry level,* such platforms provide ways for sharing common designs and for interactions across a sector. Relevant examples include operating systems (e.g. Android or Linux) and technology standards (e.g. MPEG video) that offer a common approach through which firms interact within a sector. At a *firm level*,

Box II.1. Digital platform taxonomies – a moving target

The digital platform is a fast-evolving business model. Defining such a "moving target" is challenging (Fabo et al., 2017), particularly as different taxonomies depart from different definitions. Agreeing on a clear definition is also problematic as it may have various regulatory implications (European Commission, 2016).

This box provides a short summary of existing taxonomies of digital platforms, the underlying classification criteria, methods and usability for different analytical purposes. It is based on a review of various typologies published between 2014 and 2018 by different stakeholders, including private sector consultancies, academic researchers and regional and international organizations. Some taxonomies are limited in focus and look, such as e-commerce platforms for small and medium-sized enterprises (SMEs) (Holland and Gutiérrez-Leefmans, 2018) or online marketplace start-ups (Täuscher, 2016). Others are more comprehensive (e.g. Evans and Gawer, 2016; Srnicek, 2017). Yet others enumerate the most salient business models present in a certain market at a given time (Kenney and Zysman, 2016).

Some of the taxonomies are theoretical, while others are the result of empirical observations. Most theoretical taxonomies provide a breakdown by essential elements of business functioning. They are useful for orienting analytical work on the identified classificatory aspect. For example, Oxera (2015) focuses on the type of value-chain processes with the most intensive online attributes; Ardolino et al. (2016) focus on the main functions of platforms; Srnicek (2017) looks at types of business and revenue models, and UNCTAD (2018b) examines the purposes and nature of mediated transactions.

Most empirical studies cover digital platforms originating in the United States and the United Kingdom (JP Morgan, 2016; Täuscher, 2016; Holland and Gutiérrez-Leefmans, 2018). Relatively little research has looked at the experience of developing countries. Evans and Gawer (2016), however, use a global review of 176 platforms from all regions of the world with a market valuation of at least $1 billion, from a variety of industries, the majority of which are based in North America.

Typically based on a survey of digital platforms or a secondary source of data, empirical studies shed light on various policy-relevant criteria. For example, JP Morgan (2016) distinguishes between different platform users and their degree of reliance on platform earnings. Evans and Gawer (2016) provide a breakdown of platforms by geographical origin and principal sector of economic activity. Täuscher (2016) offers a classification into six clusters based on a systematic framework of business model attributes to examine the impacts of such platforms on a firm's performance. Meanwhile, Holland and Gutiérrez-Leefmans (2018) identify five strategic groups and three clusters aimed at a better understanding of the e-commerce platforms that are useful for SMEs. The lack of data, however, makes it difficult to assess such criteria.

Some theoretical taxonomies are motivated by the need to link existing business models with specific policy areas. UNCTAD (2018b) gives special emphasis to local platforms and platforms with participation by MSMEs. The European Commission (2016) focuses on platforms that act as "passive conduits" versus those that are more "active" or have "editorial roles". ECLAC (2018) proposes a two-level classification of platforms that combines several criteria previously defined by Evans and Gawer (2016), the European Commission (2016) and Oxera (2015).

Many recent studies cite the distinction between transaction and innovation platforms (Evans and Gawer, 2016) to shed light on the opportunities and threats for future development of platforms in each market.

Beyond the analytical literature on taxonomies, there is an emerging body of literature that provides quantitative data on digital platforms for a range of other classification criteria, such as:

– Whether the platforms are B2B, B2C or C2C (based on a typology of buyers and sellers);

– By number of users, if possible, disaggregated by gender (and other statistics);[a] and

– Whether vendors from developing countries and LDCs can participate.

For the purposes of this Report, Srnicek's (2017) empirical classification into advertising, lean, product and cloud platforms is used to illustrate the ways that platforms monetize data. Discussions in this chapter and in chapter V also draw on the distinction between transaction and innovation platforms when discussing the domestic development potential that can be associated with different kinds of platforms. The UNCTAD platforms landscape for e-commerce is also presented to illustrate how e-commerce can be an avenue for value creation (UNCTAD, 2018b).

A more detailed discussion about different taxonomies of digital platforms is available in an online annex to this Report (https://unctad.org/en/PublicationChapters/der2019_annex1_en.pdf).

Source: UNCTAD.

[a] See: https://www.brandwatch.com/blog/amazing-social-media-statistics-and-facts.

innovation platforms have been created as part of product offerings, adding features for specific product models. Goods or services are defined by using shared core components and a set of complementary modules, thereby allowing a more consistent and flexible building of technologies. Examples include PC chipsets (e.g. Qualcomm) and firm-specific operating systems (e.g. Microsoft Windows) (Gawer and Cusumano, 2002).

While transaction platforms tend to be at the centre of the debate about the digital economy, there are similarities between the two types of platforms. The literature on innovation platforms has provided a sound understanding of the complementarities between platform providers and other firms or individuals who contribute to platforms (often referred to as platform ecosystems) (Tiwana, 2014), and how the opening up of platforms can drive growth (Boudreau, 2010). These concepts are useful for analysing how platforms grow and expand. As transaction platforms have grown, they have started to overlap with innovation platforms (Sturgeon, 2017). For example, Google's leadership in the Android operating system has resulted in a set of intersecting innovation platforms (Android, core smartphone designs) and transaction platforms (Google Play Store, Google Search).

A key factor that drives platform growth is related to "network effects", namely the benefits that accrue to users of a platform from additional users joining (Van Alstyne et al., 2016). Platforms involve two or more different types of transacting partners, whether they be accommodation providers and tourists (Airbnb), advertisers and consumers (Facebook) or sellers, buyers, credit card providers and logistics providers (Alibaba). Thus, beyond the direct network effects, platforms also have indirect (cross-sided) network effects, where the expansion of one side of the market increases the value for another group (Rochet and Tirole, 2006). The presence of network effects is an incentive for successful platforms to grow rapidly, as additional users make the platforms more attractive. Network effects can also generate "lock-in effects"; actors are more likely to remain on a platform, rather than migrating to competing ones, which can pose a challenge for policymakers in terms of ensuring that markets remain competitive (Gawer, 2014).

Platform-centred businesses have a major advantage in the data-driven economy. As intermediaries and providers of particular kinds of infrastructures, platform owners are positioned to record and extract all data related to events that occur between the various users of the platform. Thus, the growth of digital platforms as a result of technological developments is strongly linked to their increasing capacity to collect and analyse digital data (chapter I). While digital platforms can be involved in different economic activities and sectors, the collection (or extraction when done without the knowledge or consent of users) of digital data is an integral element of their business models. Digital platforms can facilitate value-creating interactions between the different sides of the platform, as producers and consumers of different goods and services. But essentially, their effective functioning relies on digital data, and the main source of their value creation emerges from leveraging those data in intelligent ways. Major digital platform companies consider their data pools and data-processing capacities to be a key competitive advantage. How specific firms are deriving value from such data is thus key to understanding and influencing the process of value creation and capture in the digital economy.

2. The central role of data and digital intelligence in the digital economy

Data collection and analysis have long been a feature of the economic system. Firms have always collected, processed and analysed information in the conduct of their regular business and used it for boosting their productivity. What is new is that rapid technological progress has moved this phenomenon to a different level, reflected in the exponential increase in the capacity to collect, transmit, process and analyse data through sophisticated algorithms at greatly reduced cost (chapter I). Data-related activities are no longer mere side activities in the production of goods and services; instead, they have become a central feature of the production process and a key aspect of economic activity.

This subsection looks at the complex dimensions of digital data as an economic resource, with implications for trade and development.

a. The complex nature of data

The genesis of the digital economy lies in the extraordinary amounts of detailed machine-readable information available about practically everything. These digital data arise from digital footprints of

various personal, social and business activities taking place on digital platforms that increasingly form the digital substrata of economic and social activity in virtually every sector.

Definitions from the information science literature describe data as part of a hierarchy, linked to information and knowledge.[23] In this hierarchy,

- *Data* are unfiltered symbols or signals from a variety of activities and inputs.
- Through a range of transformations (such as filtering, aggregating or ordering), the data can be transformed into *information*.
- Information can then be used to support people's experiences, skills or thinking models, which contributes to *knowledge*.

The term "big data" has been popularized to denote the broader range of data that are increasingly available to individuals, firms and societies. The "big" in big data can be defined along a number of axes: in terms of the growing *volume* of data available (e.g. from online transactions, sensors, devices); the *wider variety* of data that might be interpreted and combined with other data (e.g. unstructured data such as video and internet logs); and *velocity*, where data is generated very rapidly, and sometimes requires real-time interpretation (Laney, 2001).

Data have been compared to many other resources (most notably oil). However, while they may share some characteristics with those other resources, the singularities of data imply that these comparisons are of little help to understand their complex and particular dynamics. Data are not like anything else. One of the main characteristics of data is that they are non-rival in nature – their use by some people does not limit use by others. Thus, data can globally and simultaneously be used, replicated and reused multiple times without being exhausted. This has significant implications in terms of value in that, together with the network effects, it can lead to economies of scale and scope.

Data can take different forms. They can be pictured as a resource (or raw material), similar to capital, property or labour, as well as a form of infrastructure (Aaronson, 2018). Important dimensions of data, particularly personal data, raise issues of privacy as a basic human right.[24] Personal data have become a resource that drives much economic activity online. However, seizing the value of the digital economy requires trust online. The way in which personal data are handled and used can raise concerns regarding privacy and the security of information. This has become more evident with recent cases making the headlines, such as those involving Facebook and Cambridge Analytica. Various reports also point to continuous growth of data breaches. In the United States, the country that is the most affected by such incidents, the number of reported data breaches was 10 times higher in 2017 than in 2005.[25]

The extent to which Internet users are concerned about their privacy online varies by country. A 2019 survey on Internet security and trust conducted by the Centre for International Governance Innovation (CIGI) and Ipsos, in collaboration with UNCTAD and the Internet Society, found that 78 per cent of Internet users in 25 economies were at least somewhat concerned about their privacy online (CIGI-Ipsos et al., 2019). Concerns were found to be the most widespread in Egypt, Hong Kong (China), India, Mexico and Nigeria, where that proportion was 90 per cent or higher. By contrast, the lowest level of concern was noted in Kenya, at 44 per cent.

While there appear to be increasing concerns about data privacy and online security around the world, there is somewhat of a "data privacy paradox", as users continue to give away personal data and thus their privacy in exchange for different services. Many of these services (e.g. Internet searches, social media and online reservations) are offered by various platforms free of charge or on a take-it-or-leave-it basis. This situation has been described as someone who is not paying for a product, becomes the product.[26] Therefore, paradoxically, privacy becomes part of the economy.

While privacy is not intrinsically an economic good, since it is part of the individual, its handling could be a factor in a firm's competitive advantage. With increased public scrutiny of digital platforms, the protection of privacy may to some extent be internalized as a reputational benefit influencing the market performance of the platform owners. However, so far, such an incentive has not been sufficient.

The development and policy implications of data collection and use depend greatly on the type of data involved. Data can be classified according to different criteria, for example:[27]

- Personal or non-personal data
- Private and public data
- Data for commercial purposes or governmental purposes
- Data used by companies, including corporate data, human resources data, technical data and merchant data
- Non-structured and structured data
- Instant and historic data
- Volunteered, observed and inferred data
- Sensitive and non-sensitive data
- B2B, B2C, government to consumer (G2C) or consumer to consumer (C2C) data.

These different classifications may overlap or may be combined. Some data should not be extracted, for instance if it impinges on fundamental privacy rights. Some data, such as health data, may be usefully extracted under highly regulated circumstances. And in every case, the collection of personal data needs to be carefully considered taking into account various factors. However, many decisions on what data are extracted or not are today undertaken by the privately-owned digital platforms themselves.

Most policy discussions around data tend to focus on privacy issues and, increasingly, on data as an economic resource. Since these two major dimensions of data are intrinsically linked to the originating individual or to the collective source of the data, they cannot be easily disentangled. Thus, it may not be appropriate to assess the implications of data taking any one of these dimensions in isolation. The economic value of data, which is further explored below, should not be considered without taking due account of the privacy implications and vice versa.

b. The economic value of data

i) The data value chain

Alongside the expansion of data, its transformation into useful information for better decision-making presents additional challenges. An entirely new value chain has evolved around firms that support the production of insights from data, including data acquisition (to provide new sources of data), data storage and warehousing, data modelling and analysis, and data visualization. At the lower levels of the "data value chain", information content is limited, and therefore the scope for value generation is also low. Value increases as the information and knowledge content rises. The data value chain is graphically presented later in this chapter (figure II.1), as part of the changing models of production in the digital economy: from pipeline models to a feedback loop, circular model.

The outcome of this value chain is "digital intelligence" that can inform firms (and other organizations) in their decision-making and innovation efforts. In addition, the data can be used to improve the algorithms used for automated decision-making in the development of products, processes or services (Mayer-Schönberger and Cukier, 2013). Digital intelligence involves a certain centrality and/or abundance of machine or non-human intelligence, causing transformational impacts, for instance in the form of "intelligent production". It captures a larger set of technologies with impressively intelligent outputs (such as data analytics and algorithms). Many such technologies operate in conjunction with human and organizational contributions of intelligence and objectives to underpin the digital economy. The decisions generated may have significant impacts on socioeconomic structures.

Digital intelligence can be employed to various economic and non-economic ends. In economic terms, it can be of direct value as a service or employed in productive processes. Productivity in the digital economy is determined largely by the appropriate application of digital intelligence. In particular, high economic returns are pegged to related competencies and control. In this way, digital intelligence becomes "digital capital", which is the result of: 1) access to large amounts of relevant data; 2) control over their use; 3) mastery over processing and transforming the data into digital intelligence; and 4) their application to productive processes. The economic value of this digital capital is generated through different forms of data monetization.

ii) Data monetization

As discussed above, some digital platforms provide different products and services "free" of charge. Nonetheless, these transactions still generate value for the platform owners, as users and consumers provide them with different aspects of their personal data, such as location, preferences, relationships

and personal behaviour. Value creation arises once the data are transformed into digital intelligence and monetized through commercial use.

The interests and behaviours of digital platforms depend on how they monetize data to generate revenue. Four broad types of transaction platforms can be identified: advertising, e-commerce, product and cloud platforms.[28]

Advertising platforms include firms like Facebook and Google, which rely significantly upon advertising revenues. For instance, advertising accounts for over 80 per cent of the total revenues of Twitter and Google, and close to 100 per cent of those of Facebook and Snapchat.[29] These platforms have a strong incentive to extract and store personal data, which are key to their targeted advertising businesses. Controversies over privacy are a natural feature of this business model.

E-commerce platforms offer online marketplaces with lower transaction costs for buyers and sellers to come together. Examples include Amazon, Alibaba and eBay. A subset of this category has been labelled *lean platforms*, sometimes referred to in the context of the "sharing economy". Uber is an example, where traditional ownership of assets (e.g. taxis) is not a core part of the business. Digital marketplaces often generate income by charging a commission for each transaction. Each marketplace sets the commission it charges, and this varies considerably (table II.1). Apple, for example, has been taking a 30 per cent commission on every app sale.[30] These platforms can also use the data they collect from buyers and sellers to offer better services.

Product platforms aim to take a traditional good and turn it into a rentable service. Mobike, for example, has taken the standard purchasing of a bike and transformed it into a rentable bike-sharing service. This platform type also includes, for example, Rolls-Royce's jet engine division, which no longer sells engines but rather rents out thrust.[31] This enables the company to retain control of the data generated from the use of the products. With the growth of IoT this is set to become increasingly useful.

Cloud platforms include firms such as Alibaba Cloud, Amazon Web Services (AWS), Google Cloud Platform and Microsoft Azure. They provide "as a service" various hardware, software and development tools needed in the data-driven economy. There are also specialized platforms in manufacturing (e.g. General Electric's Predix or Siemens' MindSphere) and in agriculture (e.g. Monsanto's FieldView and John Deere's MyJohnDeere). More recently, AI is becoming a core part of these services. For businesses across the world, cloud computing promises cheaper, safer, easier and more flexible services compared with on-premise information technology. For developing countries, in particular, it could reduce the barriers to accessing large-scale and cutting-edge computing needs (Greengard, 2010; UNCTAD, 2013). As a result, cloud platforms are providing the basic infrastructure for the twenty-first century global economy.

It is important to note that individual data are of little or no value. Value emerges once data are compiled in large volumes and processed to provide insights and enable data-driven decisions by individuals, businesses, governments and other organizations. Thus, it is the capacity of digital platforms to aggregate, process, transmit, store, analyse and make sense of data that allows them to generate value. Digital data and digital platforms can therefore be viewed as two sides of the same coin for much of the value creation that takes place in the digital economy.

What is the role of different actors in the data value chain? The "raw" data producers comprise atomized platform users and consumers. While these data can have a significant *potential* for value creation, it is not possible "ex ante" to assess this value. The use of the data is not known at the collection stage, especially not by the data producer. Once collected and processed, data can be used for numerous purposes. It is only after their use that their value becomes *certain*. Thus, the potential and actual value of data are highly contextual. In this connection, although data have become an important economic resource, there is no obvious market for raw data that can be used by data producers to generate monetary value. Since the economic value emerges with the processed information and knowledge, it is only then that market-like features can be observed. At this point, the data are controlled by the platform owners, who also receive the proceeds of this value. For example, it is the transformation of the raw data into intelligence that allows companies to sell targeted advertising space. While both data producers and platforms play a crucial role in the value creation process, data producers have limited bargaining power in comparison with the digital

Table II.1. Sales fees/commissions charged by selected global platforms

Company	Description of activity	Fee	Notes
Amazon Marketplace	Retail e-commerce platform	6 per cent for PCs, 45 per cent for Amazon device accessories	15 per cent is the most common value in the table of applicable referral fees, which varies by product type (https://sellercentral.amazon.com/gp/help/external/200336920/ref=asus_soa_p_reffees?ld=NSGoogle)
eBay	Retail e-commerce platform	2 per cent for printing and graphic arts – 12 per cent for books, DVDs, music	Final value fees between 2 per cent and 12 per cent, depending on product (plus an additional insertion fee) (https://www.ebay.com/help/selling/fees-credits-invoices/selling-fees?id=4364)
AliExpress	Online retail marketplace with suppliers from China and other Asian countries	5 per cent for shoes; 8 per cent for clothing	Depends on product category (https://www.quora.com/What-does-Aliexpress-take-from-its-sellers)
Etsy	Retail platform for handmade or vintage items and supplies, and factory-manufactured items.	5 per cent +	5 per cent of the total item costs' transaction fee + $0.2 per listing + possible other fees for payment processing, currency conversion, targeted offers (https://help.etsy.com/hc/en-us/articles/115014483627-What-are-the-Fees-and-Taxes-for-Selling-on-Etsy-)
Jumia	Retail online marketplace in Africa	2 per cent for smartphones; 21 per cent for services	The commission depends on the category of item (https://vendorhub.jumia.com.ng/sp_faq/what-are-the-commissions-on-jumia/)
MercadoLibre cross-border trade	Retail e-commerce platform in Latin America; the Cross-Border Trade programme allows international merchants to sell in Latin America	16–17.5 per cent	Mercadolibre fee: Mexico: 17.5 per cent; Brazil, Argentina, Colombia and Chile: 16 per cent. Under the CBT, there are no fees for listing items (http://cbt.mercadolibre.com/us/merchant/faqs/)
Booking.com	Travel e-commerce platform	10–25 per cent	The Booking.com commission rate varies by country, ranging between 10 per cent and 25 per cent, depending on property type or location (https://partnerhelp.booking.com/hc/en-us/articles/212708929-How-much-commission-do-I-pay-)
iTunes Store	Digital marketplace for music and digital media	30 per cent	The artist often pays additional commission fees to other third parties. Difficult to retrieve all the information, but several sources suggest that iTunes collects 30 per cent (e.g. https://www.quora.com/How-much-does-an-independent-artist-make-on-a-0-99-iTunes-track-sale)
Uber	Digital platform for peer-to-peer ride-sharing, taxi cab hailing, food delivery, bicycle-sharing and other services.	25 per cent	Uber charges partners a 25 per cent fee on all fares. This fee covers the use of Uber software, collection and transfer of fares, credit card commission and distribution of invoices to clients (https://www.uber.com/en-GH/drive/resources/payments/)
Airbnb	Online marketplace for hospitality services	3 per cent + 0–20 per cent	Host service fee for homes is generally 3 per cent, but may be higher. An additional guest service fee for homes ranges between 0 per cent and 20 per cent of the booking subtotal, and is calculated using a variety of factors (https://www.airbnb.com/help/article/1857/what-is-the-airbnb-service-fee)
Upwork	Freelancing platform	2.75 per cent + 5–20 per cent	A 2.75 per cent processing fee is paid by the buyer of freelancing work + 5–20 per cent service fees for freelancers, depending on freelancers' earnings (https://www.upwork.com/i/how-it-works/freelancer/)
Shutterstock	Digital platform licensing images, video, music and editorial assets	70 per cent for footage clips; 80 per cent for customized images	Fees vary by type of product and the lifetime earnings of the contributor. Based on published earnings as a proportion of selling price (https://www.shutterstock.com/contributorsupport/articles/kbat02/000006640)

Source: UNCTAD, based on information from the companies.
Note: Data as on January 2019.

platforms, which are the ones in a position to appropriate the value.

iii) "Ownership" of data

Data and digital intelligence are important for digital economies in developed countries and increasingly also in developing countries, where a growing number of mobile apps draw on data. For example, financial services use consumer transactions and online payments data for assessing customer risk. Given the importance of data as a new economic resource for value creation, from a development perspective it becomes relevant to look at who can capture the value from this resource. This has implications both within and between countries, as it determines who stands to gain and lose in the digital economy.

In the traditional economy, property rights in well-established markets comprising producers and consumers strongly determine who is the beneficiary of the value of the corresponding goods and services. With regard to data, the situation is less clear, as it is difficult to establish "ownership" of the data. Indeed, given the specific characteristics of data, ownership may not even be the appropriate term. The value of personal data is tied to the data subject or producer, and this cannot be sold. What matters more are the control, access and rights over the data. Under the current system (or non-system), digital platforms are often the main collectors or extractors of data, and can therefore appropriate the value. The data sources (i.e. the data producers or data subjects) are not able to capture any part of the economic value created with their data. Moreover, there is a risk of misuse of information, which can do harm to the user and to others. Once the data have been extracted, users typically have limited or no control over how these are used.

Two basic legal approaches to data as an economic resource are possible: treating data as a commons or as private property. If considered as a commons, adequate legal provisions and practical tools would be required to enable all the entitled people, communities and businesses to access and use all such data on an equal footing. This would entail a particular structure of the digital economy, which would differ radically from what currently exists. On the other hand, if data were to be treated as private property (within a broader human rights framework), the basis of such economic rights over data would have to be specified, as is the case for land, capital and intellectual property. If some kind of mixed approach to data were to be preferred, with some data treated as a commons and some as private property, both the means for its commons-based use and the basis for the data's "ownership" would need to be established conceptually, in law and in practice.

Individual rights to data are beginning to be addressed more comprehensively, for example in the context of data protection regulations (see chapter VI). But data can also identify and target harm at a group or community of people. Some data have a strong commons or public goods aspect, such as traffic data from a ride-sharing application that could help city authorities with the management of traffic. Rights over collective data may extend beyond the requirement for specific public interest applications, as the relevant community (which is the source of the collective data) may want to exercise its full rights over what is done with the data, including its economic application by private companies.

Unlike natural, other physical and various forms of knowledge resources, the value of data is unique in the sense that it cannot meaningfully ever be entirely separated or divested from the data subjects – whether individuals or groups/communities. Data's real – or at least greatest – value is in the intelligence that can be derived about the data subject, which value obviously can (mostly) only be exercised in relation to the specific data subject – individual or community. Data therefore has a significant use (or abuse) value, but not an exchange value similar to that of most economic goods. The necessary and inalienable embeddedness in the relevant group/community strengthens the case for close community access, control and rights over its data, and of the digital intelligence that can be derived from that data.

Collective ownership approaches may also be based on the fact that the greatest value of data lies in their relationship with other data in order to provide insights or intelligence. Indeed, much of the real value of data is relational or social. Moreover, as data can be used and reused without necessarily diminishing their value, groups and communities that are subjects of group/community data could retain their rights to maximize the value of the data by sharing these among their members, and, if they find the data safe and rewarding, with trusted outsiders. This could be done in a manner that retains enough incentives for data collectors.

Practical reasons related to complexities and high transaction costs of control of data by different individuals, as well as asymmetries in bargaining power, might also justify a collective approach.

Such community/national data "ownership" regimes may not apply to all data. As noted above, digital data come in many different forms. Every communication across the world, from a telephone call to video conferencing, constitutes a flow of data. Such flows are not problematic in this context. A lot of data is in the form of creative content, such as films and music, whose global flows are subject to different kinds of intellectual property (IP) regimes. Further, much data are of a technical nature, like software. Such technical data should be able to cross borders freely, subject to IP, security and other relevant legal considerations. However, data which are either about an individual (personal data) or a community (community data) require particular attention. The latter could be about a community's social relationships or about artefactual or natural "things" owned by the community, such as public infrastructural and environmental data.

Economic rights over data and digital intelligence may therefore require *sui generis* frameworks, enabling data subjects – individuals and groups/communities – to control how the data about them are used; they could license certain trusted parties to derive value from them in a manner that ensures that the interests of the data subjects remain primary, but without ever fully relinquishing their basic rights to the data.

B. A FRAMEWORK FOR ASSESSING VALUE IN THE DIGITAL ECONOMY

This section examines the concept of value in the digital economy with a view to understanding its potential impacts on development. The outcomes of a growing digital economy are often uneven, both within and between countries, and there can be different direct and indirect impacts, both positive and negative.

1. Implications of the data-driven economy

The growth of the digital economy can lead to many new economic opportunities but also to uneven impacts and negative spillovers. Impacts can be considered across several dimensions (e.g. productivity, gross domestic product (GDP), value added, employment, income and trade), for different actors (e.g. workers, MSMEs, platforms and governments), and for different components of the digital economy (e.g. the core digital sector, the digital economy and the digitalized economy). Impacts will vary by country and region. Moreover, even if individuals, firms and countries do not, or only partially, take part in the digital economy, they can still be indirectly affected. For instance, low-income workers may find themselves marginalized by more efficient workers in digitally enabled sectors, or they may lose their jobs due to automation. And incumbent local firms that do not digitalize may no longer be able to compete with domestic and foreign firms that do.

Digital data and digitalization can help improve economic and social outcomes, and be a force for innovation and productivity growth (box II.2). The infrastructure provided by platforms can enable more effective transactions, networking and exchange of information. From a business perspective, the transformation of all sectors and markets through digitalization can lead to the production of more and better goods and services. Data and information can also be useful for improving processes and increasing access to markets. Through their use of data, firms can better meet the needs of consumers by offering on-demand goods and services, and customized products.

In developing countries, at the level of the firm, a growing digital economy does not automatically lead to an expansion of opportunities for local digital firms (Foster et al., 2018). Major platforms and data providers shaping local digital economies have tended to be owned by large multinational enterprises (MNEs), or by digital firms operating from afar (Caribou Digital, 2016; Evans and Gawer, 2016) (see chapter IV). Local firms can emerge through the expansion of "digital ecosystems"' – the decentralized set of firms, data and processes that are connected through their use of digital resources – particularly related to supporting online platforms. In developing countries, digital ecosystems are made up of local start-ups (such as payment providers, logistics or mobile app/service providers), which are all important for localizing digital services (Bukht and Heeks, 2017). While providing more opportunities for skilled work in the digital economy, these firms often end up in

Box II.2. Digital technologies and the productivity paradox

Usually, ICTs have been considered a driver of productivity and economic growth. Different reviews reveal that these effects tend to be positive, particularly at the firm level (OECD, 2012b; Stanley et al., 2018). However, the rapid process of digitalization during the past decade does not seem to have translated into strong productivity growth; on the contrary, that growth has slowed (Crafts, 2018). This slowdown appears to be more of an issue in developed countries, but has also been observed in developing countries (APEC, 2018).

This is known as the productivity paradox, as Solow (1987: 36) put it: "You can see the computer age everywhere but in the productivity statistics". Updating this by changing the word "computer" for "digitalization" would better define the productivity paradox in the digital economy.

Different reasons for this paradox have been provided. Those with a more pessimistic view about the effects of technology on productivity (e.g. Gordon, 2016) see the evolving digital technologies as having much less impact than the technological advances that characterized previous technological revolutions. A more optimistic perspective attributes the slow productivity growth to the time lags before the effects of digital technology uptake kick in. It is likely that when these technologies are adopted in wider segments of the economy, there will be more visible impacts on productivity (OECD, 2019b; Remes et al, 2018)

Difficulties in measuring the digital economy (see chapter III) have been considered an additional factor to explain the productivity paradox. The fact that activities in that economy are not properly recorded in overall GDP statistics could also explain the slow productivity growth. If properly measured, these would be reflected in higher output, and therefore higher productivity.

Moreover, other factors not related to digital technologies may also be responsible for the slowdown in productivity growth. A notable example is the low aggregate demand and limited investment that characterized the period following the 2008 global financial crisis. Slow productivity growth in developed countries has also been attributed to demographic factors related to an ageing population (Maestas, 2016).

The jury is still out on the causes of this paradox, but most of the explanations cited above probably hold some truth. However, the productivity paradox seems to be more of a feature in those countries – mostly developed countries – that are close to the digital technology frontier. Therefore, it is likely that for developing countries that are far from the technological frontier, the scope for productivity gains from an increasing use of digital technologies is still significant.

Source: UNCTAD.

uneven relationships with large platform providers, the decisions of which shape the activities, profits and ultimately the direction of growth of the smaller players (Srnicek, 2017).

By creating digital market institutions and values (like trust and norms), digital platforms can reduce transaction costs compared to the analog world, thus creating opportunities, especially for MSMEs in domestic and foreign markets (Autio et al., 2018; Lehdonvirta et al., 2018). They may open up new markets, lower the barriers to entrepreneurship, bring in non-professionals and peers, and provide new sources of finance to small-scale start-ups (OECD, 2017a). Sussan and Acs (2017) refer to such platforms as "digital entrepreneurial ecosystems"; Karippacheril et al. (2013) observe that competing mobile telephony platforms are innovating to serve the poor with new services; and Koskinen et al. (2018) argue that platforms may alleviate institutional and infrastructural challenges in developing countries.

For individuals, digital platforms allow access to more variety and choice of goods and services at lower costs. They also provide convenience as well as customized or personalized products and services. Consumers may further benefit by getting goods and services quicker due to fewer intermediaries. Moreover, in terms of employment, an expanding digital economy in developing countries can generate new high-skilled jobs, especially in the core digital sector and in areas requiring relatively advanced technical and analytical skills. However, they generally provide fewer opportunities for low-income groups (UNCTAD, 2017a; World Bank, 2018a).

Some countries are addressing this drawback by promoting other types of digitally enabled productive activities, such as low-skilled "digital work", as a potential first step to participation in the digital economy (Graham and Mann, 2013). Policymakers and practitioners in some developing countries are promoting the growth of IT-enabled services and impact outsourcing in order to provide jobs and learning opportunities (Beerepoot and Keijser, 2014; Heeks and Arun, 2010). So far, the success of such interventions remains unclear. They may have led mainly to the creation of new, low-wage, unstable, digital work. Meanwhile, individuals in the broader economy also face challenges as a wider range of economic sectors digitalize. New technologies in production and improvements in productivity may lead to technology-driven changes in jobs, which could push down wages or lead to layoffs (Frey and Rahbari, 2016).

From the government perspective, improvements in economic activity due to digitalization-related productivity increases could result in higher tax revenues. They could also induce greater efficiency in terms of service delivery through e-government. Additional benefits include the use of data for development purposes and for solving societal problems, such as those related to various SDGs. Data collection and analysis could help manage or resolve critical global issues, assist in the creation of new scientific breakthroughs, advance human health, provide real-time streams of information (e.g. on disease outbreaks or traffic conditions), monitor the natural environment, improve the efficiency of resource use, and support decision-makers in government, businesses and civil society. In sub-Saharan Africa, for instance, large sets of data on soil characteristics are being mined to help determine fertilizer needs and increase productivity. Moreover, digital data can provide opportunities for compiling indicators to support the 2030 United Nations Agenda for Sustainable Development, while there are legal, ethical, technical and reputational challenges involved (MacFeely, 2019).

Platforms may also incorporate firms and actors into the digital economy, for example by providing improved access to export markets through e-commerce or cloud work (UNCTAD, 2017a). However, these may sometimes be under adverse terms (e.g. low profits or an unstable environment) (IT for Change, 2017). Digitalization of the broader economy may lead to new efficiencies, and, in the future, to transformative changes in established sectors in developing countries. With growing efficiency and automation of production, work previously performed in developing countries may disappear, or alternatively become "reshored" back to the more advanced economies (Banga and Willem, 2018; Hallward-Driemeier and Nayyar, 2018).

The above discussion hints that the positive impacts of the digital economy are not a given, nor widely shared. Moreover, there are increasing concerns about the risks it poses, such as the rising concentration and market power of global digital platforms, unfair business practices and potential for rent-seeking monopolies.[32] Traditional brick and mortar sectors and small companies may suffer in the digitalization process. Digitalization can result in negative effects on employment as a result of job losses in affected sectors (as noted earlier), with consequent polarization and increased inequality. In addition, digital platforms may adopt tax optimization practices which reduce government revenues. Beyond purely economic aspects, there are increasing concerns about issues related to privacy and security, democracy and ethical failures, as well as the risks of mass surveillance and digital colonialism (Couldry and Mejias, 2018; Mayer-Schönberger and Ramge, 2018; Zuboff, 2015).

From an international perspective, there can be diverse and unclear impacts on trade, depending on, for example, a country's level of development, trade structure and digital readiness. Developing countries may risk ending up in a "data trap", at the lower levels of the data value chains, and become dependent on global digital platforms. Major economic challenges posed by the digital economy are discussed in more detail in chapter IV.

A summary of potential impacts of the data-driven economy by type of actor and for different parts of the digital economy (digital sector, digital economy and digitalized economy), as depicted in figure I.1 is presented in table II.2. This can provide useful guidance for assessments of the potential impacts of the digital economy. It could also help for evaluating variables that may need to be measured in this regard (see chapter III). Other impacts related to environmental, ethical or democracy issues, for example, could be added. However, while from a broad perspective these may also be considered as important value-related dimensions, they go beyond the scope of this Report, which focuses on economic value.

Table II.2. Potential impacts on value creation and capture from an expanding digital economy, by its components and actors

DIGITAL ECONOMY COMPONENT	ACTORS				ECONOMY-WIDE IMPLICATIONS
	Individuals (as users / consumers and workers)	MSMEs	Multinational enterprises / digital platforms	Governments	
Core, digital sector	• New jobs for building and installing ICT infrastructure. • New jobs in telecom and ICT sector, especially ICT services.	• Greater inclusion under suitable circumstances or spillovers/domestic linkages. • Increased competition from cloud-service providers.	• Investment opportunities for companies that meet high capital, technological and skills requirements.	• Attracting investment. • Tax revenues from the economic activity created.	• Increased growth, productivity and value added. • Employment creation. • Investment and diffusion of technologies; R&D likely located in high-income countries. • Mixed trade impacts.
Digital economy	• New jobs in digital services, especially for highly skilled people. • New forms of digital work, including for the less skilled.	• New opportunities in digital ecosystems. • Increased competition from foreign digital firms.	• Enhanced productivity from data-driven business models. • Greater control of value chains using platform-based business models. • New opportunities in the sharing economy.	• More tax revenue resulting from increased economic activity and formalization of enterprises. • Lost customs revenue from digitalization of products.	• Higher growth, productivity and value added. • Employment creation/losses. • Higher investment. • Aggregation of digital firms in some locations. • Mixed trade impacts. • Market concentration.
Digitalized economy	• New jobs in ICT occupations across industries. • Need for new skills as higher-value roles are redesigned using digital tools. • Greater efficiency of services received. • Job losses or transformation due to digitalization. • Risk of worsened working conditions. • Improved connectivity. • More choice, convenience, customization of products for users and consumers. • Lower consumer prices.	• Platform-enabled market access. • Reduced transaction costs. • Risk of "race to the bottom" in markets vs. ability to find a niche. • Lost opportunities due to automation (e.g. logistics, business processes). • New roles in service provision. • New business opportunities for digitalized enterprises.	• Emergence of platform firms with data-driven models. • Gains from efficiency, productivity and quality. • Opportunities for the monetization of data. • Increased competitive advantage to digital platforms. • Increased market power and control of data value chain. • Leading digitalization in different sectors.	• Increased efficiency of services through e-government. • Increased revenue from customs automation. • Unclear impact on tax revenue: increases from higher economic activity; losses from tax optimization practices by digital platforms and MNEs. • Data-driven opportunities to meet various SDGs.	• Growth through improved efficiency in sectors and value chains. • Productivity improvements. • Innovation impacts. • Potential crowding out of local firms in digitally disrupted sectors. • Potential automation in low- and medium-skill jobs. • Wider inequality. • Mixed trade impacts. • Impacts on structural change.

Source: UNCTAD.

Net impacts for the overall economy are hard to predict, not least because of difficulties in appropriately measuring the digital economy (chapter III). Moreover, since the world is only at the early stages of the digital economy, there is not enough experience or recorded evidence to assess successes or failures in order to reach strong conclusions. The rapid pace of technological progress further complicates assessments about potential impacts.

However, the impacts of the data-driven economy are likely to be uneven. Within countries, differences may arise not only between digital platform owners and users, but also between digital platforms and workers or individuals offering services through the platforms, and between global digital platforms and MSMEs. This is likely to be the case also between the private and public sectors, between men and women, and between urban and rural areas, in view of persistent digital divides in these areas.

The goal for policymakers, as well as for society as a whole, will therefore be to maximize the potential positive impacts of the digital economy – ensuring that these benefits are widely shared – and minimize the negative effects. There is an important role for proactive policies to guide the digital economy in a positive direction (chapter VI). However, as impacts are highly contextual, there is no one-size-fits-all approach to preparing for the digital economy. A better understanding of what constitutes value in such an economy could help policymakers better articulate relevant development goals and related policy actions.

2. Dimensions of value in the digital economy

A useful approach for analysing value in the digital economy is to distinguish four specific dimensions: the distribution of value, the scope for upgrading, the governance of value creation and the difference between value creation and value capture. These are briefly explored in this section.

a. Distribution of value

In the modern economy, economic production is typically fragmented through networks, supply chains or ecosystems of interconnecting firms. Value is divided amongst a range of firms in countries at different levels of income (and on to workers) in uneven ways. Of specific relevance for developing countries is the practice of leading firms (often MNEs based in developed countries) to outsource certain elements of their activities in order to focus on their core skills and competencies (Prahalad and Hamel, 1990). The activities of more marginal firms in many developing countries are often considered to be of "lower value" whether in terms of the value of the goods or services produced, lower labour intensity or lower skills requirements, and as such these activities may also be more 'footloose' (Gereffi, 1994). Thus, examining the conditions of value across interconnecting firms and workers is central to analysing value creation and capture. The aspects chosen to explore (e.g. income, price, wages, profits, gender balance, or rural vs. urban location) depend on the objective of the analysis. In the digital economy, for example, an analysis of labour outcomes has shown that workers in low-value digital work (e.g. click workers) and digital ecosystem activities (e.g. mobile finance agents), while involved in creating value, often hold unstable and poorly paid positions (Berg et al., 2018; Foster, 2014). If such activities grow, they might lead to negative outcomes at the economy-wide level. Consequently, an understanding of the distribution of value may serve as a basis for considering redistribution policy options.

b. Scope for upgrading

While low-value positions may be associated with limited productivity gains in the short term, firms or individuals might, over time, be able to dynamically upgrade, though this is not automatic. It necessitates a strategy for learning and improvement, whereby individuals or firms dynamically move from lower value to higher value activities (Gereffi et al., 2005; Kaplinsky and Morris, 2001). In the digital economy, low-value activities may provide a means of entry into networks and ecosystems of production, which in turn would provide a source of learning, technology access and better value over time. For example, small tourism service providers may upgrade to selling directly online to customers. Some start-ups in developing countries have also been able to upgrade from simple to higher value-added service provision (UNCTAD, 2017a). Thus, it is important to explore and support paths for process and product improvements or innovation, whereby firms create more value from their productive activities or upgrade.

c. Governance of value creation

The distribution of value and the dynamics of upgrading are greatly affected by decisions made by the most powerful lead actors in the value chain. Various conditions may limit the ability of firms to upgrade to

higher value roles, such as those related to the way goods and services are delivered, the quality of the outputs, the costs and skills, the technologies and the language skills required to deliver goods and services to customers (Gereffi, 1994; Ponte and Gibbon, 2005). Barriers to upgrading can also be linked to personal preferences and connections, policies and rules, long-standing norms and culture (Foster et al., 2018). These dynamics are often shaped by the major lead firms. The notion of governance indicates that control by selected private firms does not always occur directly, but as indirect or ongoing interactions, with rules or norms shaping the upgrading paths (Ponte and Sturgeon, 2014). In the digital economy, governance can be explored in terms of older lead firms in digitalized value chains, but also newer actors, such as digital platform companies, which influence the scope for upgrading (chapter IV). The global power centres of governance in the digital economy tend to be located in a few selected economies, raising potential concerns for policymakers about reach and vision.

d. Value creation vs capture

It is important to recognize the difference between value creation, addition and capture (Coe and Yeung, 2015; Henderson et al., 2002). As implied by the discussion on upgrading, a focus on value typically relates to value creation and value addition by different actors, and their role in creating value in production. From a development perspective, upgrading from a lower value position to a higher one is thus seen as positive. However, this observation may fail to take into account the dimension of value capture, which is "the ability for firms to retain their surplus within their organisational boundaries" (Coe and Yeung, 2015: 171). This point might also be extended to consider value capture by different countries (e.g. through government revenue). Actors in improved positions of production may find that their value is being extracted elsewhere. The concept of value capture is highly relevant in the digital economy. Firms and workers moving into the digital economy, who are involved in online activities, are often seen as upgrading their skills. However, it is problematic if the bulk of the value they create is captured elsewhere. For example, low-income taxi drivers may be perceived as advancing due to their use of apps, mapping and communication, but if they are in uneven relationships vis-à-vis the platform firms (e.g. because of paying high commission fees), these arrangements may not be desirable or sustainable in the longer term.

C. CHANNELS FOR VALUE CREATION IN THE DIGITAL ECONOMY IN DEVELOPING COUNTRIES

This section outlines how the digital economy can affect value in developing countries. It focuses on three particular trends: platformization, e-commerce and value-chain digitalization.

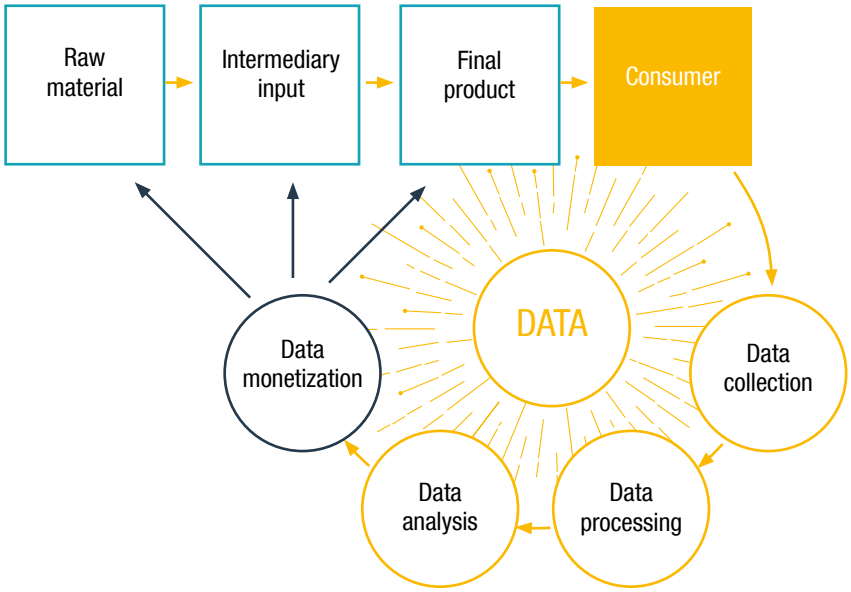
1. Platformization

Digital transaction platforms can have disruptive effects in a number of sectors. The process of platformization has implications both for the nature of transactions within certain sectors and for the ability of firms to scale rapidly, thus affecting sectors' structures.

Regarding the nature of transactions, there is a trend to move from linear, "pipeline" models of interactions towards transaction forms using platforms (Van Alstyne et al., 2016). In the pipeline models, goods and services are produced along a set of linear activities and "pushed" to the customer through a series of stages which add value. While not necessarily excluding the existence of a supply chain, platformization implies a gravity shift in value creation towards the platforms themselves. Through platforms, there is a relatively low entry bar for firms and individuals to provide a more diverse range of products, services and customers. They move from "push" models to "pull" modes of activity, by providing the support and services needed for parties to perform transactions on the platform (Cusumano and Gawer, 2002).[33]

Thus, in the platform economy, the traditional understanding of supply and demand (and of production and consumption) as clearly separable dualities – with production consisting of a linear supply chain of integrated firms, each adding a piece of value towards an output from which a passive consumer derives a private utility – no longer applies. The new economic model works in a circular manner as a feedback loop in which data and interactions (i.e. the network) are the main resource and source of value (see figure II.1). The upper part of the figure represents the traditional model, from raw material to consumer products, while the digital economy is represented in the full figure. The lower part of the figure also represents the data value chain discussed above. Indeed, in the digital economy, what is prevailing is an omnichannel approach. As the world is digitally

Figure II.1. From linear production to feedback loops in the digital economy



Source: UNCTAD.

transitioning, production processes and transactions may be taking place at different combinatorial possibilities between the physical and virtual world. Thus, they may be just physical, a combination of physical and digital, or purely digital.

The power of platform business models is partly related to their ability to enable firms to achieve economies of scale more rapidly. Rather than being the owner of specific goods, services or labour, a platform often operates by "creating a new market place" for different parties to transact, and in this sense it is "physical asset light" (at least in the early stages). The global expansion and dominance of so-called ride-sharing platforms illustrate this phenomenon. By (initially) not owning the core assets (taxis) and employees (taxi drivers are contractors), they invest lightly in human and physical assets which enable more rapid expansion at low costs (Parker et al., 2016). Platform firms are also compilers and users of big data, as the ownership of platforms allows them to harvest rich data generated by the interactions of users from all sides of the platform. These data are used to develop the "digital intelligence" needed to improve the platforms and related services. The data may also be sold on to third parties. Rapid scaling has been seen in developing-country platforms, as illustrated by firms such as Go-Jek in Indonesia, Ola in India and Careem in MENA and Pakistan, all of which have been able to compete with established transportation services with relatively small assets, some expanding outside their own borders.[34] However, in many developing countries there are significant barriers to such scaling (chapter V).

In principle, the risk of physical asset-light expansion is that users can rapidly switch to competitors, for example if they offer better conditions. To counter this risk, platform owners may seek to control certain activities on their platforms, pushing platform lock-in or adopting uncompetitive practices (Parker et al., 2016) (see chapter IV).[35] When platforms grow dominant in the market, it becomes difficult for practitioners or policymakers to find alternative options.[36]

Platformization therefore highlights a broader change in the digital economy, where different platforms (as opposed to supply chains, nations or sectors, for example) are the basis for understanding the division of value. As sectors are likely to include multiple platforms, exploring the way they are "layered" or "interact" is important for analysing the wider economic implications.

Opportunities in developing countries may arise in the new "pull" dynamics of platforms, where it is in the interest of platform owners to support the market entry into broader markets of as many small firms and end users as possible. Digital firms can also emerge in

developing countries to support platform ecosystems. However, there is a risk of platform "lock-in", and of platform firms accentuating their market power in different ways. This is of particular concern for smaller firms or individuals who may find themselves becoming dependent on platforms under adverse conditions with few alternatives. There appears to be potential for developing-country digital firms to adopt platform models and become local leaders, but competing against established global digital platforms with much greater market power is a huge challenge (as discussed in chapters IV and V).

Whilst both platform owners and users (e.g. buyers and sellers) can create value, its distribution among the different stakeholders tends to be highly uneven. Major platform leaders are generally in a position to impose additional costs or fees on the firms using their platforms. Firms will need to consider the trade-off between these costs and broader market opportunities. In terms of upgrading, some studies suggest that platformization can help smaller firms in developing countries reach wider markets (eBay, 2013). More research is needed on the trajectories of these firms as they develop within and across platforms. Similarly, it is important to explore the trajectories of value creation for developing-country firms that are part of digital ecosystem services. The extent to which these types of trajectories exist is a key consideration for enabling policymakers to understand the broader economic implications of platforms.

2. E-commerce platforms

A second and related trend concerns the way platforms are shaping user-producer relationships through e-commerce, including by leveraging customer information and interaction to a much greater extent than in traditional commerce. E-commerce platforms bring together a broader range of buyers and sellers and provide opportunities for offering a greater variety of goods and services (Mayer-Schönberger and Cukier, 2013).

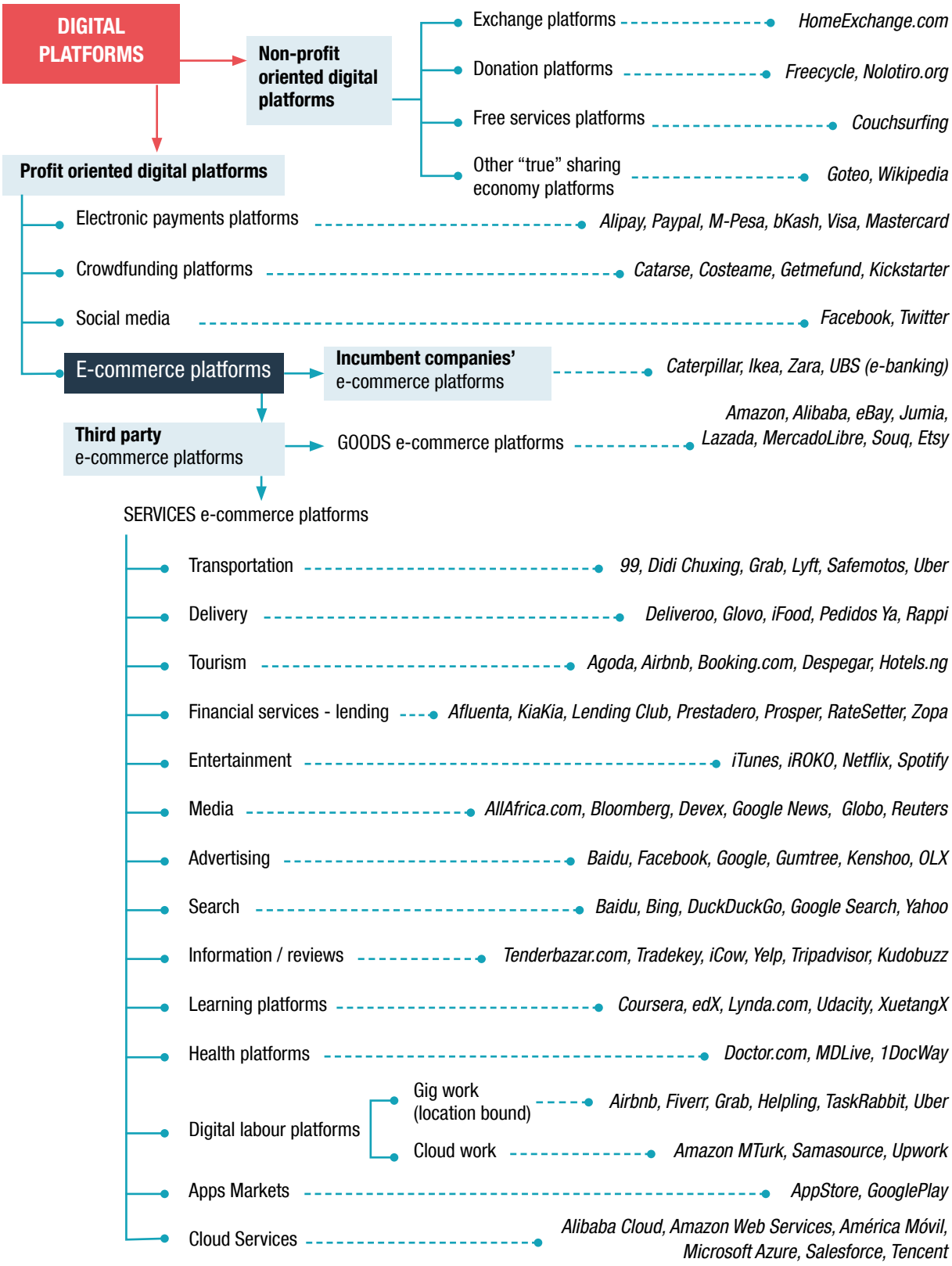
Figure II.2 provides an illustration of the new e-commerce landscape, distinguishing between profit-oriented and non-profit-oriented platforms. Non-profit-oriented digital platforms are marginal compared with the profit-oriented ones. Given that some platforms are multipurpose, they may feature in several places in the figure. The examples presented include platforms from both developed and developing countries. A few major e-commerce platforms (e.g. Amazon, Alibaba Group, eBay and Rakuten) are capturing significant segments of the overall market, benefiting from economies of scale and network effects. However, in many developing countries, the global platforms may not be present, or they may be complemented by national or regional ones, such as Jumia in Africa, MercadoLibre in Latin America, Lazada in South-East Asia and Flipkart in India. Locally oriented platforms have sometimes been able to grow owing partly to the absence of global competitors in the local market (see chapter V). They may provide more convenience for consumers through shorter shipping times, tailored payment options, products more suited to local markets and local language interfaces. Other potential benefits to the domestic real economy may be related to linkages with local industries and suppliers, reduced reliance on imports and greater openness to support exports.

Data generated on these platforms provide valuable insights into consumer behaviour and opinions, and how the platforms are working. Firms on e-commerce platforms can use their data to develop intelligence that can help improve product designs, as well as to innovate (Srnicek, 2017). More active users are also contributing to new forms of value in e-commerce through user-induced innovation (von Hippel, 1988), or as producers (sometimes called "prosumers"). Thus, consumer/user activities can provide a potential base for firms to dynamically improve and add value to their products and services (Dong and Wu, 2015; Ritzer and Jurgenson, 2010).

In some developing countries, the number of firms able to take advantage of these new platform interactions with customers has expanded. In China, for example, a range of platforms provide a diverse set of opportunities for small firms in the apparel sector (Li et al., 2018). Frequent interactions between small firms and local markets on platforms typically provide the impetus to firms to shift from generic production to building specific branded products over time. Similar processes have been observed in some tourism firms, where the use of platforms and customization have been important for creating value (Foster, 2017).

In sum, studies of micro and small enterprises suggest that platforms have the potential to become an important crucible for value creation linked to e-commerce. New forms of governance are still driven by the global e-commerce providers, but central to these firms' business models is the aim of facilitating the use of their platforms and services. Governance of value may also be shaped by other cross-cutting firms in production, such as global logistics firms and

Figure II.2. E-commerce in the landscape of digital platforms



Source: Updated from UNCTAD, 2018b.

payment providers. Small firms in many developing countries may be able to become part of platforms due to relatively low barriers to entry. New value capture is linked to data capture and innovation based on customer interaction, as well as to the way in which customers' activities on the platform are embedded in production activities. E-commerce platforms themselves capture considerable value from exchanges through commissions or fees, although more research is needed to understand the use of commissions and how they vary across firms and sectors, as well as how they evolve over time. In developing countries where the largest online sellers still often dominate the market, there are challenges for local firms to upgrade (Chen et al., 2016). Moreover, for many small firms, price-driven competition in a national or even global market can drive down profits. Nevertheless, there can be potential for upgrading, as demonstrated by the incremental improvements of some tourism providers and smaller clothing producers.

3. Digitalization of value chains

In addition to the disruptive shifts in how goods and services are delivered in the digital economy, it is worth considering the more gradual changes linked to the broader digitalization of existing production networks, and the potential effects on the creation and distribution of value (Foster and Graham, 2017). More specifically, digitalization and datafication affect the way value chains – be they regional or global – are governed.

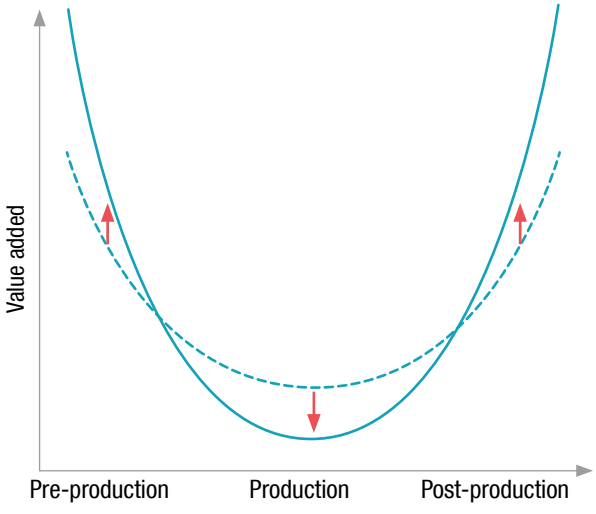
Two changes are especially relevant in this context: modularization and servitization of value chains. A number of studies have argued that digitalization accelerates "modular" governance of value (Foster et al., 2018; Sturgeon, 2017). This implies that firms in a value chain increasingly produce relatively standardized components. This changes the value chain in that these modular goods and services are of lower value than those produced "upstream", where firms introduce novelty and innovation, and where modules are combined together closer to customers (Sturgeon, 2002). For instance, tourism providers are increasingly standardizing their goods and services to meet requirements set by online travel agencies. Similarly, agricultural production is increasingly standardized, monitored and tracked as it moves along the value chain. Retail-oriented firms outside developing countries tend to create more value from these processes (Fold, 2001).

Digital technologies are also an important element in supporting the servitization of manufacturing processes, where manufacturing and services increasingly overlap. These technologies are driving the unbundling of services and making them more "tradable", thus supporting more complex networks of services in the production of goods and services.

For conceptualizing the role of services in shifting value in the digital economy, the "smile curve" illustrates the impact of the digital economy in terms of specific segments of production as shown in figure II.3. The dotted line represents the current state of affairs in terms of where value is added in production.

Increased digitalization, modularization and servitization may result in a shift towards the solid line shown in the figure, where value added in production decreases and that in pre- and post-production increases (Hallward-Driemeier and Nayyar, 2018; Mayer, 2018; Rehnberg and Ponte, 2018). In production, the growth of services is likely to accelerate process automation, leading to a decline in value added at these stages. Meanwhile, an expansion of digitized services will mainly occur in the pre-production stage (such as a wider range of design software and data-driven services to inform new goods and services) and in the post-production stage (such as in services embedded in software and enhanced after-sales services).

Figure II.3. The smile curve and the impact of digitalization



Source: UNCTAD, adapted from Mayer, 2018; Rehnberg and Ponte, 2018; and Sturgeon, 2017.

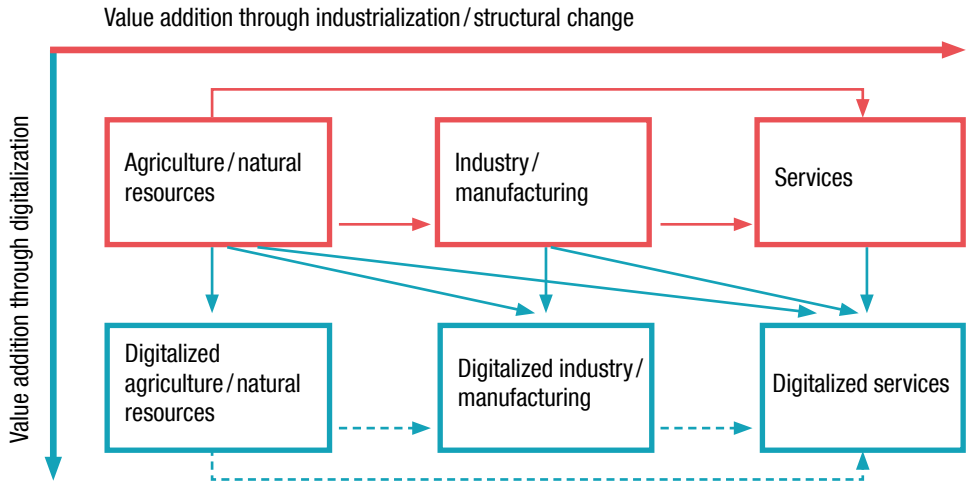
The net outcome may generate mixed impacts in developing countries. Digitalization can vastly reduce transaction costs in production. Alongside this, servitization can reduce costs that allow the incorporation of more smaller firms into higher value-added activities in value chains (UNCTAD, 2017a). However, current evidence suggests that, as goods and services become standardized and datafied, the control of production shifts increasingly from smaller firms to leading supply chain organizers and retailers, as well as to major platform companies. Smaller producers may find their outputs more monitored and standardized, making producers more easily interchangeable and thus vulnerable. This poses risks for firms that are pulled into chains where digitalized standards may increase (Kumar, 2014) and lead firms can more easily switch suppliers.

The digital economy also impacts traditional value chains in which value and governance still closely relate to tangible goods. In these cases, modularization and servitization, driven by digital technologies, can make leading firms more focused on innovation while production activities with lower value are outsourced to other actors. Governance of modularized systems by lead firms in value chains is facilitated by digital tools and systems that provide new ways of assessing and tracking standards and quality performance. As a result, value is increasingly captured by those actors that control the data and digital resources needed to manage production. For firms in most developing countries, modularized and servitized value chains are potentially less costly to administer and control, and, as shown in the agricultural sector (such as sorghum production in Africa), they can expand the potential for small firms to enter and participate in globalized production at a lower cost (see IFDC, 2015). At the same time, other studies (e.g. of tea and coffee production) suggest that increased digital control of value chains may reduce the flexibility of actors to find new approaches (Foster et al., 2018).

D. NEW PATHS FOR VALUE ADDITION, STRUCTURAL TRANSFORMATION AND DEVELOPMENT

Economic development has traditionally been associated with the process of structural transformation. This implies moving up in the value chain from low productivity and value-added sectors to higher productivity and value-added sectors. In practice, this has been observed in sectoral changes in production, from agriculture and other natural resources, towards industry – especially manufacturing – and then to higher value services. This is reflected in the upper part of figure II.4, in the horizontal direction. Value addition here occurs through the process of industrialization and structural change.

Figure II.4. From industrialization to digitalization



Source: UNCTAD.

With digitalization, a new dimension for potential value addition emerges (moving in the vertical direction in figure II.4). Digitalization can take place in agriculture, industry/manufacturing and services, as reflected in the lower part of the figure. This involves adding value through the data value chain of data collection, data processing, data analysis and monetization of the data. In this way, the digital economy opens additional paths for potential value addition.

Value can be added to the economy by moving to the right in the two parallel dimensions (i.e. the non-digitalized sectors and the digitalized sectors). While the processes of value addition reflected in the traditional sense of structural change remain valid, in the digital-economy context, the economy can also move from agriculture to all digitalized sectors. There can still be a shift from traditional industrial activities towards non-digitalized services, but now also to digitalized industry (also known as Industry 4.0) and digitalized services. Value addition in the services sector can be achieved by moving up the value chain to digitalized services.

In the digital economy, there may also be value addition without structural change in the traditional sense. If all three traditional sectors digitalize simultaneously, there may be no change in the sectoral composition. But by adding value through digitalization in all sectors, there could be structural transformation *within* the sectors. Similarly, an economy could register value addition and increase its productivity in the agriculture/natural resources sector and/or the services sector through digitalization without necessarily industrializing in the traditional sense. This may be of particular interest for those developing countries in which the weights of the agricultural and services sectors are relatively high. Moreover, the distinctions between sectors are becoming more blurred (reflected by the dotted lines in the chart). Overall, it is important to consider the potential for value addition and development stemming both from traditional structural change and from digital transformation.

Some authors use the term "digital industrialization" by comparing industrialization (value addition) in the industrial era with value addition in the digital era (Singh, 2018). However, in the latter case, which involves adding value along the data value chain (the vertical dimension of the figure), the digitalization process affects all sectors, not only manufacturing. Therefore, using the terms "digital industrialization" or "digital industrial policy" may be misleading. An alternative approach would be to refer to value addition in the digital economy and industrial policy in the digital economy. Similarly, it may be more appropriate to talk about "trade in the digital economy", rather than "digital trade", and "skills for the digital economy" rather than "digital skills".

E. CONCLUDING REMARKS

This chapter has provided a conceptual basis for analysing value creation and capture in the digital economy. Two dimensions are particularly important: platformization and the growing reliance on digital data. Any assessment of the implications for value creation and capture needs to distinguish between different stakeholders and between different parts of the digital economy.

Digitalization creates both opportunities and challenges from the perspective of developing countries. The net impact of digital disruption depends greatly on the level of development and digital readiness of countries and of stakeholders within countries. It also essentially depends on the policies adopted and enforced (chapter VI). Digitalization influences value chains in different ways, especially through platformization, modularization and servitization. It also opens up new means of value addition and structural change.

Whereas the conceptual framework can be of significant value for policymakers, practitioners and researchers, using it empirically is often hampered by the lack of relevant statistics. This is the focus of the next chapter.

Notes

22 For more details on this topic, see Rochet and Tirole, 2003 and 2006; Baldwin and Woodard, 2009; and Gawer, 2009.

23 See, for instance, Dalkir 2005; and Davenport and Prusak, 1998.

24 The United Nations has a long history of promoting the right to privacy through human rights treaties (see, for example, UNCTAD, 2016).

25 See: https://priceonomics.com/why-security-breaches-just-keep-getting-bigger-and/.

26 See, for instance, *The Conversation*, 19 April 2018, If it's free online, you are the product; and *Forbes*, 5 March 2012, If you're not paying for it, you become the product.

27 These examples are based on GSMA, 2018; OECD, 2019a; and Swedish National Board of Trade, 2014.

28 Based on Srnicek (2017), this is an empirically derived list, rather than one derived from first principles. It is thus likely that new platform types could be added in the future.

29 Data from 10-Q SEC filings for 2018Q3.

30 See *Reuters*, 25 November 2018, How much for that app? U.S. top court hears Apple antitrust dispute.

31 See *The Economist*, 8 January 2009, Britain's lonely high-flier.

32 See, for example, IMF, 2019a.

33 At their most basic, virtually all platforms include rating, reviews, filers and comments that (in theory) help customers to choose the appropriate product or service. But many platforms have expanded beyond this. For example, in order to support MSMEs in China, Alibaba has progressively offered a wider array of services to pull them into its platform, including credit, warehousing and free cloud software to run small businesses, with the goal to improve their ability to trade professionally on the Alibaba platform. They also have the advantage of supporting lock-in of the customer to the platform.

34 See, for instance, *Reuters*, 18 October 2018. Mideast ride-hailing app Careem raises $200 million to expand, expects more funds; and *The Guardian*, 7 August 2018, Indian ride-hailing firm Ola to take on Uber with launch in UK.

35 For example, Android pushes users to use only software from the Google Play platform to maintain its control of apps and commission levels.

36 In the case of Google Play, only China has set high-level interventions by demanding that local equipment providers offer their own app stores on their devices. The EU is seeking a remedy for this situation through the European Court, but for policymakers in most developing countries, actions and lock-ins of global platforms are generally difficult to challenge.

Measurement of the digital economy and its impacts has grown in importance as more and more economic activities are getting digitalized. Greater demand for better statistics that can support policymaking has led to a renewed interest in identifying which digital economy activities can add the most value and how best to measure that value. While several initiatives are being undertaken by the international community to define and quantify the digital economy, more work is needed. There are various ways to capture the extent and impact of that economy. This chapter, largely due to statistical limitations, focuses on the core digital (or ICT) sector. This includes value added, employment and trade related to the production of ICT goods and services. Attention is also given to value created as a result of digitalization in other parts of the economy, resulting in more people working in ICT occupations and in digitally delivered services and e-commerce. The chapter further looks at some recent efforts at measuring value added in e-commerce, capturing spillover effects from the digital economy and value linked to the data-driven economy.

MEASURING VALUE IN THE DIGITAL ECONOMY

MEASURING VALUE IN THE DIGITAL ECONOMY

More needs to be done to improve measurement

Need for **agreed definitions** of value in the digital economy

Need to collect **official statistics**

What do we know about the size and the scope of the digital economy?

Global digital economy estimates range from:

Narrow definition

4.5% of GDP

Broad definition

15.5% of GDP

US: digital economy in 2017 has been estimated to account for:

Narrow definition

6.9% of GDP

Broad definition

21.6% of GDP

China: digital economy in 2017 has been estimated to account for:

Narrow definition

6% of GDP

Broad definition

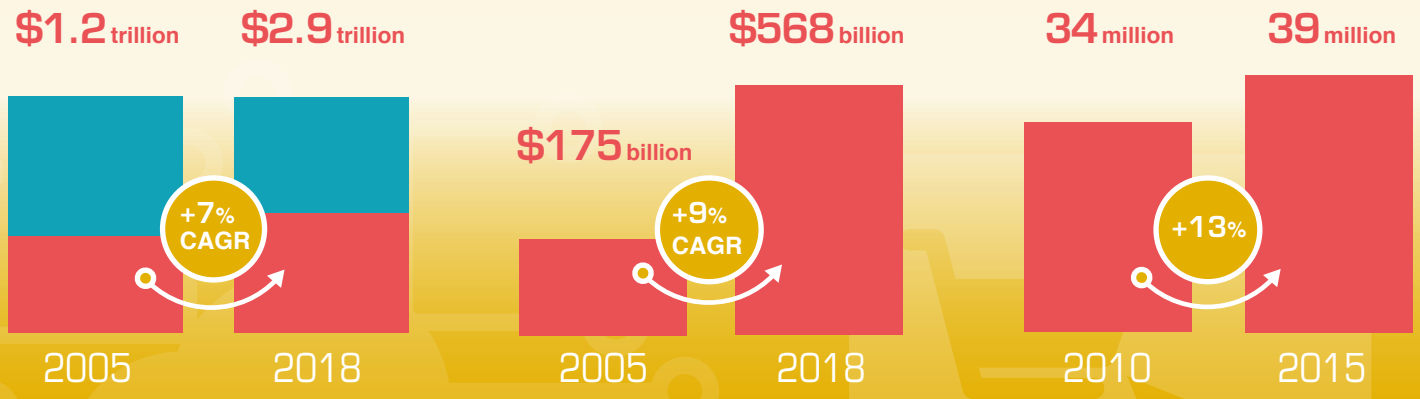
30% of GDP

Growing importance of digitalization in the global economy

Share of the **digitally deliverable services** exports in the **global services exports**

Global **ICT services exports**

Global **employment** in the **ICT sector**



More needs to be done to make progress in measurement of the digital economy, especially to support developing countries in building statistical capacities to produce relevant information.

A. CHALLENGES TO MEASURING VALUE IN THE DIGITAL ECONOMY

1. Measuring the different dimensions of the digital economy

A first challenge to measuring the digital economy, and therefore its value, is the lack of a universally accepted definition (chapter I), which makes international comparisons difficult. This report builds on the conceptual representation of the digital economy displayed in figure I.1, which distinguishes between its core, narrow and broad scopes. The core and narrow dimensions relate to ICT infrastructure and the ICT-producing sector, as well as to digital and platform-based services. The broader scope refers to the use of various digital technologies for performing different economic activities. While the core and narrow scopes are closely associated with the digital sector, the third category can be called the digitalized economy, as it is increasingly encompassing all sectors of the economy.

Ideally, the measurement of value in the digital economy should cover all three levels: the digital sector, the digital economy and the digitalized economy. A country should be able to assess their implications in terms of different economic variables, such as value added, employment, wages, income, prices and trade, as well as for different agents, at these three levels. This could be based on the framework presented in chapter II (table II.2). However, comparable statistical data are available mainly for just the core digital sector, and even in this case there are significant gaps, particularly concerning developing countries. The lack of statistical data and other measurement difficulties increase as the analysis moves from the core to the broad scope of the digital economy.

For the purpose of measuring the digital economy, the use of the System of National Accounts can present conceptual challenges associated with translating the new economic activities into statistical data. One challenge concerns the intangible nature of digital data and intelligence, which are major determinants of value creation in the digital economy.[37] In this context, accounting for related economic activities in the data-driven economy becomes problematic. It is also difficult to capture statistically the ways in which digitalization is having an impact on activities outside the production boundaries of the pure digital sector. Moreover, some activities in the digital economy, such as the creation of content or exchange of digital data, may be monetized only indirectly (e.g. by selling targeted advertising space online). This applies to many online platforms that provide "free-for-use" services for the right to use the data generated by users of online services.[38]

The transnational nature of major digital platforms also poses measurement challenges, especially regarding where to locate an economic transaction. In the case of cloud computing, for example, the customer, data centre and address of the supplier may be in different countries. Similarly, online platforms based in one country can facilitate transactions between buyers and sellers located in other countries. Governments may find it difficult to obtain statistical information about activities of digital platforms that are active in their countries but that lack a physical presence there. In such circumstances, securing survey responses from the platform companies is harder, and official administrative data may not be available. Although it is sometimes possible to scrape certain items of data (e.g. prices) from web pages, other data about the economic activities supported by digital platforms (e.g. transactions within online marketplaces or smartphone apps) are seldom available.[39]

There have been some efforts to define the digital economy and to improve its measurement in the context of satellite accounts. One example is the definition of the digital economy adopted by the United States Bureau of Economic Analysis (BEA). It identifies three aspects: a) digital-enabling infrastructure needed for a computer network to exist and operate; b) e-commerce, which includes digitally ordered, digitally delivered, or platform-enabled transactions (B2B, B2C and peer-to-peer or P2P); and c) digital media, which refer to content that users in the digital economy create and access, including free digital media and big data. While the first and third components largely overlap with the core and narrow scopes of the digital economy, the inclusion of e-commerce activities falls within the broad scope in figure I.1 (see also section III.F.2). The BEA points to the challenge posed by the rapidly changing nature of technology in defining the digital economy. For example, a refrigerator that is connected to the Internet and transmits data raises the question of whether it should be treated as an ICT product or just as a refrigerator with some digital features (Barefoot et al., 2018). Ideally, the definition of the digital economy should allow for

the changing nature of what it encompasses over time as new technologies emerge.

Some relevant international statistical definitions and classifications do exist, such as for the ICT sector, ICT occupations and trade in ICT goods and services. However, for many other relevant areas (such as IoT devices), universally accepted definitions are yet to be established. But even in areas for which there are agreed definitions, there is often a glaring lack of statistics. This is particularly true in developing countries, but sometimes also in developed countries.

Finally, and partly related to the lack of agreed definitions, there is insufficient support by the international community for technical assistance and statistical capacity-building for measuring the digital economy in developing countries. As the evolution of the digital economy raises various new policy issues – in areas as diverse as the labour market, education and skills, innovation, sectoral development, trade, environmental protection and energy efficiency, among others – finding ways to improve the collection and availability of relevant statistics is of growing importance. As observed by the Argentinean Group of 20 (G20) Presidency in its new Toolkit for Measuring the Digital Economy (G20 DETF, 2018: 6):

> Even if we only consider existing measurement efforts, there is ample room for improvement, as data are far from being comprehensive, country coverage is limited, timeliness is often an issue, and differences in data collection methodologies and approaches across countries persist.

2. International initiatives for measuring the digital economy

A wide range of international organizations and other groups, within the scope of their organizational mandate, are involved in statistical work related to different aspects of the digital economy. This partly reflects the cross-cutting nature of digitalization and its impact on many policy areas and spheres of economic activity. However, few organizations have tried to measure the digital economy in a holistic manner.

The Partnership on Measuring ICT for Development is an international, multi-stakeholder initiative launched at the UNCTAD XI Ministerial Conference in 2004 to improve the availability and quality of ICT data and indicators, particularly in developing countries. The Partnership counts 14 members and has, among other things, identified a list of core ICT indicators and methodologies to collect related statistics. It has helped to create a clear division of labour among organizations related to the measurement of different aspects of the information society, and it facilitates more effective cooperation.[40] For example:

- The International Telecommunication Union (ITU) is responsible for the measurement of telecommunication and ICT topics such as ICT infrastructure, ICT access and use by households and individuals, as well as some indicators related to e-commerce and ICT skills.[41]
- The International Labour Organization (ILO) undertakes methodological work through the International Conference of Labour Statisticians, which deals with employment aspects of the digital economy. This includes employment in the ICT sector or in ICT-related occupations, but also areas such as informal employment and work-related aspects of digital platforms.
- UNCTAD provides methodological guidance and technical assistance for its member States in areas such as ICT use by enterprises, the ICT sector and trade in ICT goods and services. It collects relevant data both for developing and transition economies. It is also an active participant in international initiatives aimed at improving the availability of statistics on e-commerce and trade in the digital economy. In addition, it has developed methodologies for measuring exports of digitally delivered services (see section III.D).[42]

The recently established Intergovernmental Group of Experts (IGE) on E-commerce and the Digital Economy convened by UNCTAD aims to build international consensus on issues to do with relevant statistics. On its advice, UNCTAD is establishing a new Working Group on Measuring E-commerce and the Digital Economy, which will support dialogue and policy development, and help improve the availability of relevant statistics, particularly in developing countries. It will also seek to identify specific measurement opportunities and challenges for developing countries.

The Inter-agency Task Force on International Trade Statistics (TFITS) works to foster international cooperation on trade statistics. It has considered a number of topics of relevance to the digital economy, including trade in ICT goods and services, and, more recently, digital trade.

The OECD is involved in efforts to measure the digital economy, through forums such as the Working Party on Measurement and Analysis of the Digital Economy. It has developed guidelines for measuring the information society, which are periodically reviewed and revised. In 2014, it benchmarked its member countries along several relevant dimensions, identified gaps, and developed a measurement agenda. In addition, the OECD's Going Digital project, launched in 2017, is developing an integrated policy framework to better understand the economic and societal transformations being brought about by digital technologies and to propose appropriate policy responses. For each relevant policy domain, it defines key benchmark indicators and relevant policy levers, along with work to review existing metrics and identify gaps. The organization has also commenced work on the measurement of areas such as artificial intelligence (AI), IoT, digital security and privacy, consumer trust in online environments, skills in the digital era, barriers to trade in digital services, and digitalization and the future of work.[43] The OECD focuses mainly on the needs and capabilities of its member States, most of which have relatively advanced statistical offices. The situation in these countries is often considerably different from that of developing countries, and especially LDCs, where statistical capacities are much more limited.

In close collaboration with the OECD and other international organizations, the G20 produced a Toolkit for Measuring the Digital Economy, which outlines a measurement agenda for the digital economy and analyses the situation in G20 countries with reference to 35 indicators. It also highlights statistical gaps and suggests actions for improvement.[44]

There are also some regional initiatives. For example, the European Union (EU) has a digital scoreboard that measures the performance of the EU and its member States in a range of areas, from connectivity and digital skills to the digitization of businesses and public services. It also produces the Digital Economy and Society Index. In addition, it has established a Monitoring Framework for the Digital Economy and Society.[45] Another example is the observatory of the digital ecosystem in Latin America and the Caribbean created by the Development Bank of Latin America (CAF, 2017).[46]

Most developing countries need to improve measurement of the digital economy and their statistical capacity in this area in an integrated manner. Lack of statistical data prevents policymakers and other stakeholders in these countries to prepare adequately for the new digital era. Typically, countries that are the least prepared for the digital economy also have the least amount of statistical information that could help their governments make well-informed decisions. The new UNCTAD Working Group on Measuring E-Commerce and the Digital Economy could help them by supporting a holistic approach to measuring the digital economy in their countries.

Statistical data available to assess value in the digital economy mainly cover the ICT sector and, to a lesser extent, ICT employment and e-commerce. However, most of the gains from the digital economy are likely to result from the digitalization of all the sectors of an economy, and not only the digital sector. In developing countries, where agriculture and services account for large shares of the economy, most gains may be expected to accrue from the digitalization of these sectors. The analysis that follows illustrates how some components of the digital economy can provide opportunities for growth in developing countries.

B. VALUE ADDITION IN THE ICT SECTOR

The ICT sector is well-defined, with international classifications comprising ICT manufacturing, ICT wholesale trade and ICT services.[47] Nonetheless, the availability of statistical data for developing countries is limited in this area as well, and there is an insufficient level of disaggregation. In this report, value added for the ICT sector is estimated using available statistics from international and national sources.[48]

1. Overall trends in value added in the ICT sector

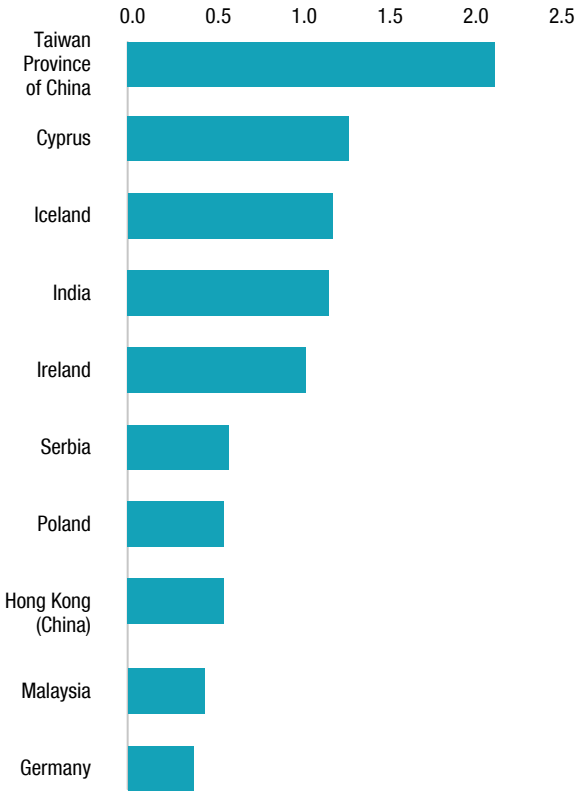
Value added in the ICT sector has not kept pace with overall GDP growth. Despite the increase in access to ICTs over time (chapter I), the share of this sector's value added in world GDP has remained stable over the past decade, averaging around 4.5 per cent. The global average may hide diverging developments by country, or that price reductions in ICT products have been accompanied by increases in volume. In terms of the composition of the ICT sector, computer services is the largest subsector by value added, accounting for 40 per cent of the sector in 2015.

On an individual economy basis, some economies saw growth in the share of the ICT sector's value added in their GDP between 2010 and 2017 (figure III.1). Taiwan Province of China ranked first, owing to growth in ICT manufacturing. India was in fourth place, with growth driven mainly by computer services. Other developing and transition economies featuring in the top 10 included Serbia, Hong Kong (China) and Malaysia.

In terms of value added, the United States has the world's largest ICT sector, almost twice the size of the second largest, China. Other Asian economies in the top 10 by value added include Japan, the Republic of Korea, India and Taiwan Province of China (figure III.2). In terms of the share of the ICT sector's value added in GDP and its distribution by subsector, four of the top five economies are in East Asia and have notable ICT manufacturing industries, with Taiwan Province of China in the lead (figure III.3). Ireland is second, with its ICT sector's value added accounting for 10 per cent of GDP, mainly due to large United States computer services MNEs using Ireland as a regional base for tax reasons. India ranks tenth, with computer services constituting more than 70 per cent of its ICT sector's value added.

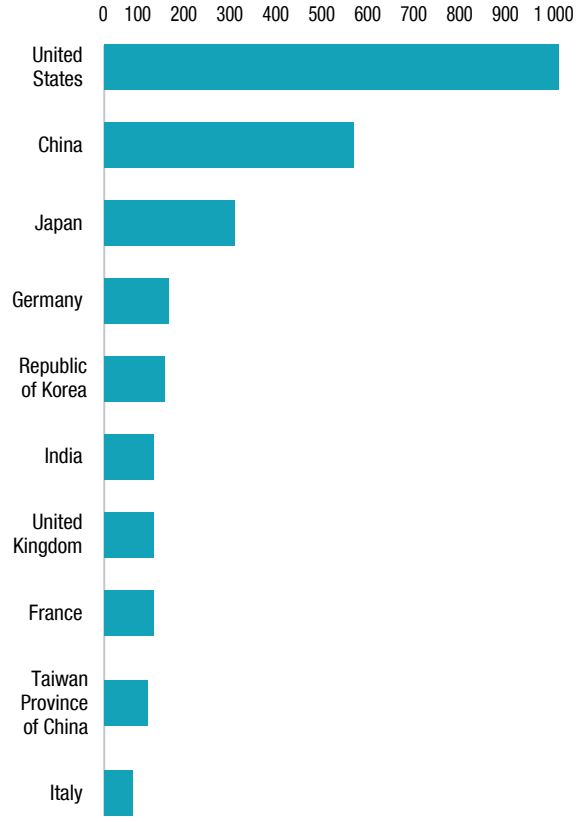
Despite increased digitalization, the share of the ICT sector's value added in GDP has declined in the majority of developing and transition economies for which statistics were available (figure III.4). This may reflect the internalization of digitalized activities in sectors other than the ICT sector. The only places where it grew faster than GDP were in some Asian and transition economies plus Costa Rica.

Figure III.1. Growth in the share of the ICT sector's value added in GDP: Top 10 economies, 2010–2017
(Percentage points)



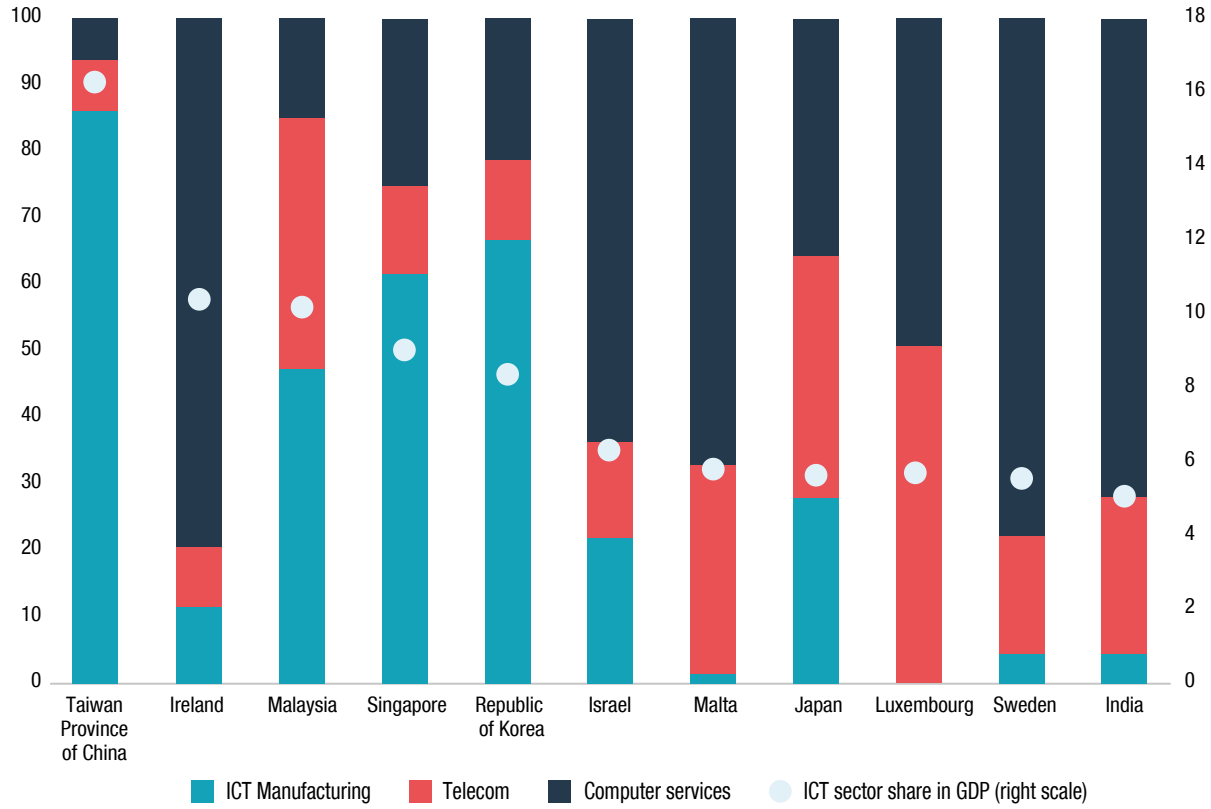
Source: UNCTAD, based on international and national sources (see annex to this chapter).

Figure III.2. Value added in the ICT sector: Top 10 economies, 2017, or latest available year
($ billion)



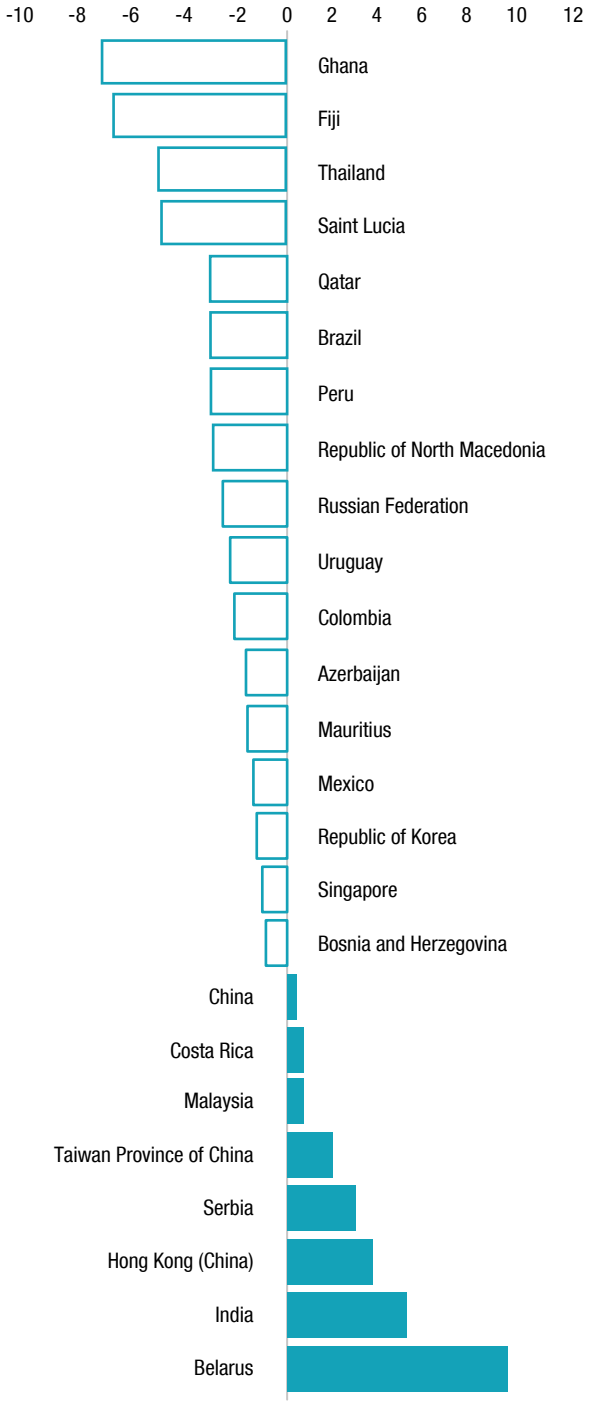
Source: UNCTAD, based on international and national sources (see annex to this chapter).

Figure III.3. Share of the ICT sector's value added in GDP, and its distribution by subsector: Top 10 economies, 2017
(Per cent)



Source: UNCTAD, based on international and national sources (see annex to this chapter).
Note: Data for Ireland refer to 2014, China and India to 2015, and Israel, Japan and Malaysia to 2016.

Figure III.4. Growth in ICT sector value added as a share of GDP, selected developing and transition economies, 2010–2017
(Per cent)

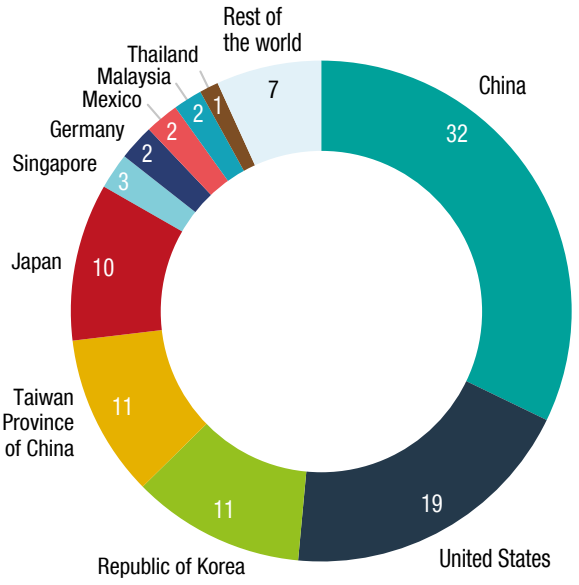


Source: UNCTAD, based on international and national sources (see annex to this chapter).
Note: The figures reflect the difference in the share of the ICT sector's value added in GDP between the latest and earliest years for which data were available.

2. Value added in ICT manufacturing

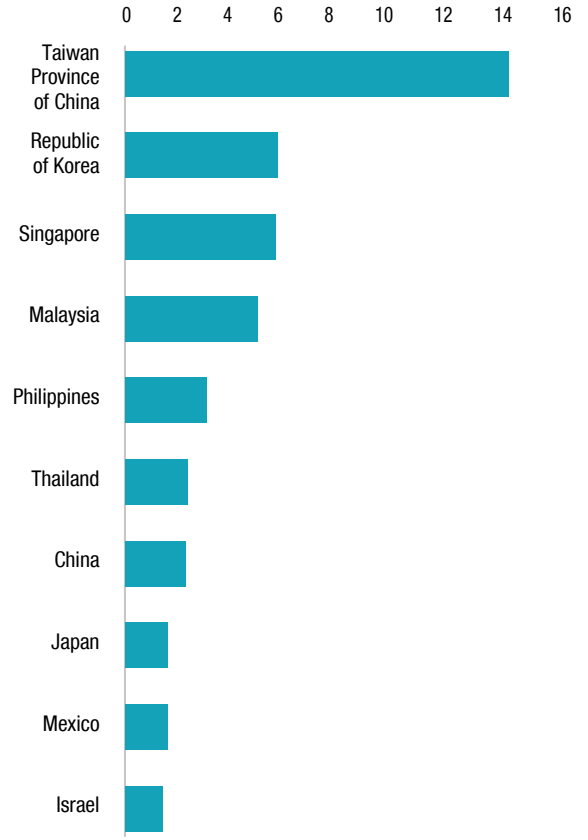
Global ICT manufacturing is highly concentrated. Ten economies account for as much as 93 per cent of this subsector's global value added (figure III.5). In 2017, East Asia, led by China, accounted for 70 per cent of the total. This reflects the prominent role of this region in global value chains related to electronics. The United States accounted for almost a fifth of the total, with most added value emanating from research and development (R&D) and design rather than manufacturing (Delautre, 2017). Mexico is the only developing country outside East Asia among the top 10, as it benefits from its geographical proximity to the United States. Germany is the only European country in the list. In terms of the share in GDP of value added in ICT manufacturing, the eight leading economies are all in East Asia (figure III.6).

Figure III.5. Geographical distribution of value added in ICT manufacturing, 2017
(Per cent)



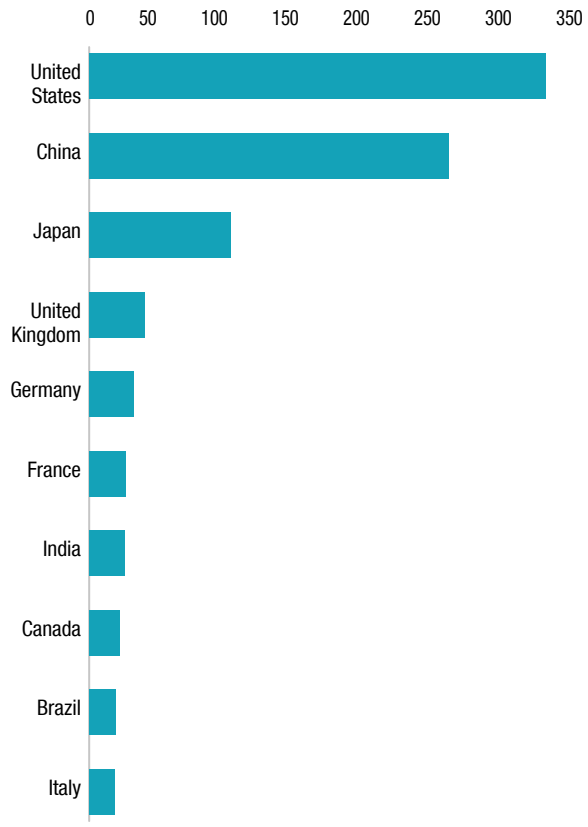
Source: UNCTAD, based on international and national sources (see annex to this chapter).

Figure III.6. Value added in ICT manufacturing as a share of GDP: Top 10 economies, 2017, or latest available year
(Per cent)



Source: UNCTAD, based on international and national sources (see annex to this chapter).

Figure III.7. Value added in telecommunications: Top 10 economies, 2017, or latest available year
($ billion)



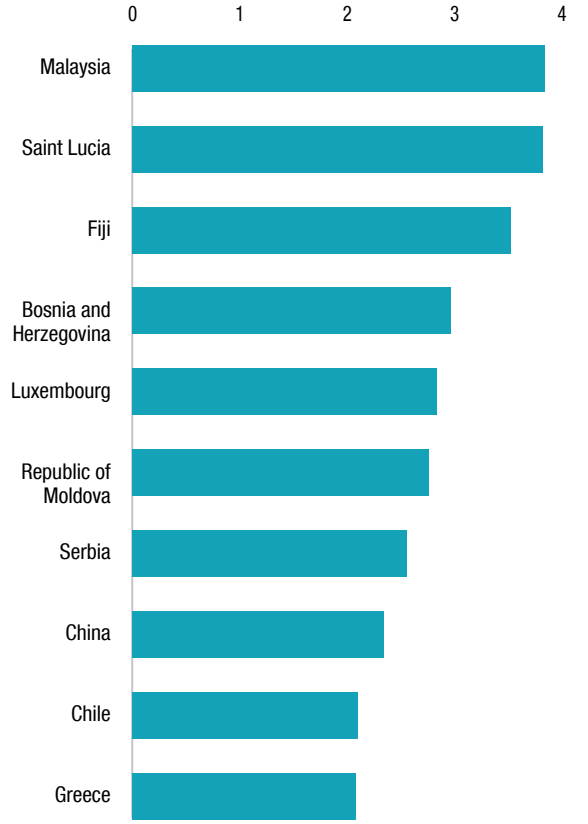
Source: UNCTAD, based on international and national sources (see annex to this chapter).

3. Value added in telecommunications and computer services

Among the countries for which ICT sector data were available, three of the largest producers of telecommunication services are populous developing countries, namely China, India and Brazil (figure III.7). Regarding their share of telecommunications value added in GDP, eight of the top ten are either developing or transition economies, including two small island developing States (SIDS) (figure III.8).

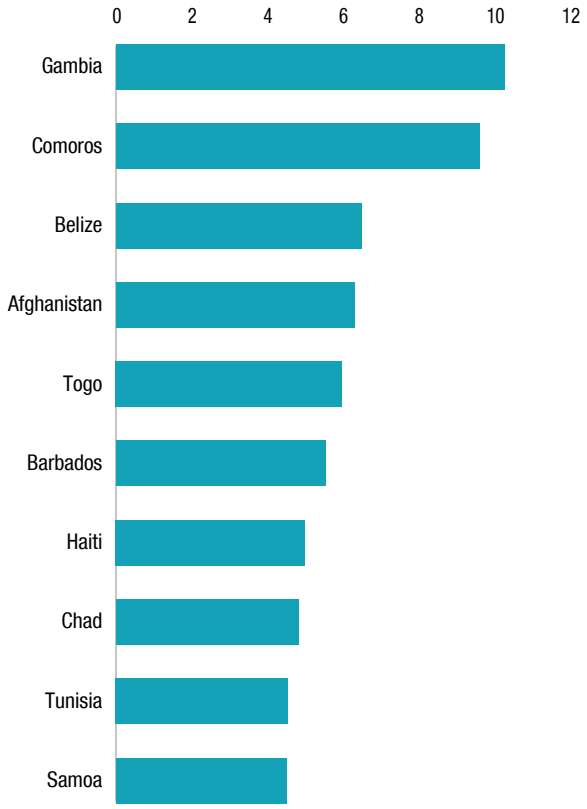
In most low-income developing countries, telecommunications dominate the ICT sector. They are indispensable and are not tradable, unlike ICT equipment, computer and information services. While international communications are traded through routing calls, every country needs its own network, whereas it can import ICT equipment and computer services to satisfy domestic demand. Around 80 countries compile national accounts data for the communications industry (which includes posts that typically account for less than 5 per cent of the total). Five of the top 10 economies in terms of the share of communications value added in GDP are LDCs, led by the Gambia, where the telecom sector accounts for 10 per cent of GDP (figure III.9). Many SIDS also have high shares.

Figure III.8. Value added in telecommunications as a share of GDP: Top 10 economies, 2017, or latest available year
(Per cent)



Source: UNCTAD, based on international and national sources (see annex to this chapter).

Figure III.9. Value added in communications services as a share of GDP: Top 10 economies, 2015
(Per cent)

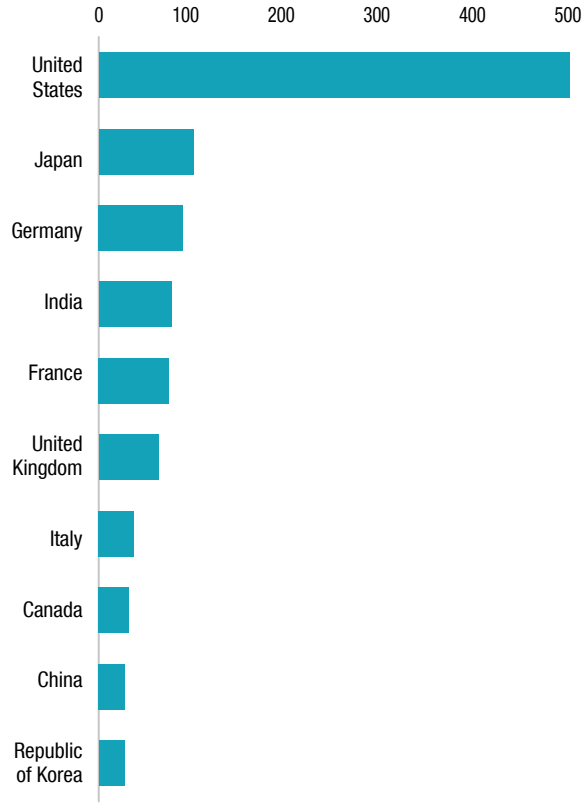


Source: United Nations, *National Accounts Official Country Data* (http://data.un.org/Explorer.aspx?d=SNA).
Note: The top 10 refers to countries that compile national accounts using ISIC 3.0.

Value added in the global computer services industry is the largest in the United States (figure III.10) – almost as large as that of the combined total of the next nine economies. This is because seven of the world's largest IT companies are based in the United States, many of which derive all or most of their revenues from computer software and services (e.g. Microsoft, IBM and Oracle).[49]

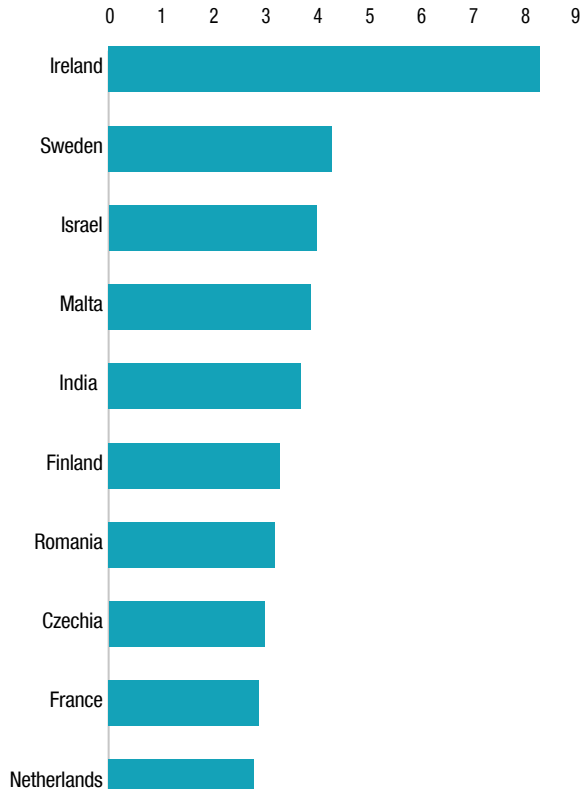
Ireland tops the list of countries in terms of value added in computer services as a share of GDP by quite a significant margin, reflecting the strong presence of regional offices of United States digital companies, followed by Sweden (figure III.11). Unlike for other parts of the ICT sector for this indicator, only one developing country (India) features among the top 10. Although known for its exports of computer services,

Figure III.10. Value added in computer services: Top 10 economies, 2017, or latest year available
($ billion)



Source: UNCTAD, based on international and national sources (see annex to this chapter).

Figure III.11. Value added in computer services as a share of GDP: Top 10 economies, 2017, or latest available year
(Per cent)

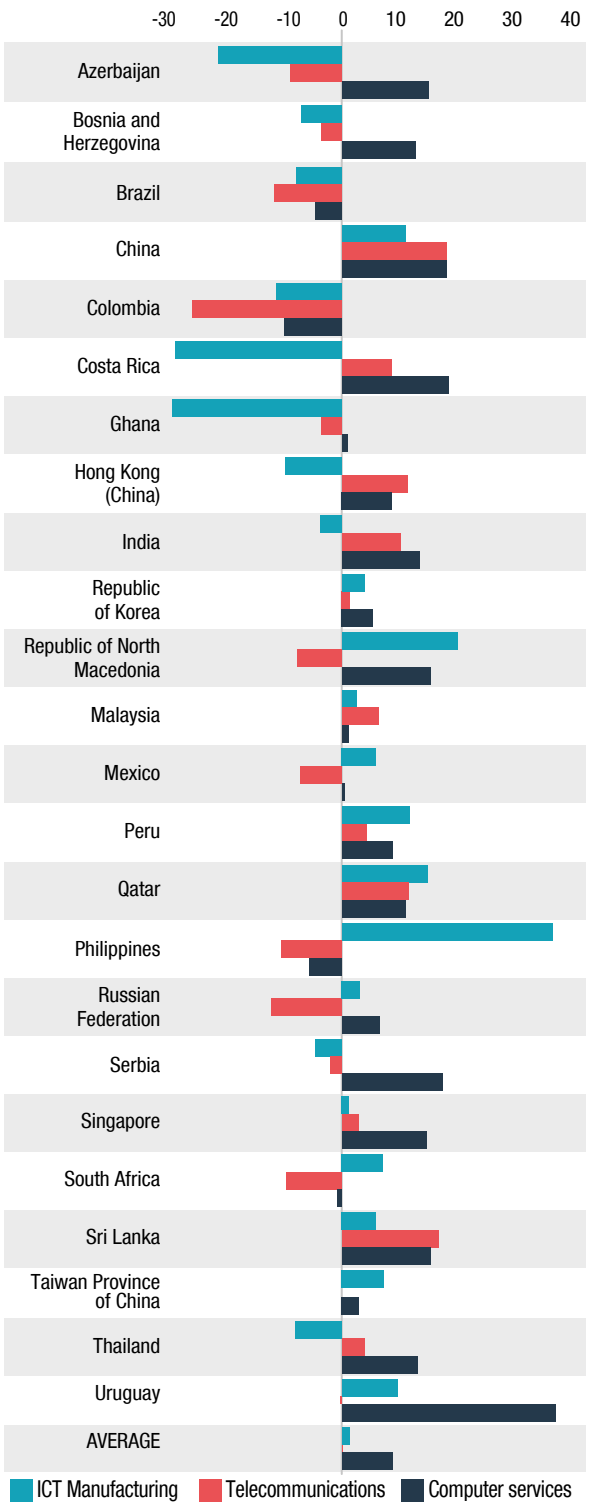


Source: UNCTAD, based on international and national sources (see annex to this chapter).

the domestic market for these services in India is forecast to grow faster than their exports, fuelled by the Government's Digital India programme,[50] its burgeoning start-up and venture capital scene, and increased computer use by MSMEs. The next highest developing economy is Costa Rica, which ranks 19th. Apart from India and Israel, all the other economies that rank high based on this indicator are European.

Looking at value added growth in the ICT sector by subsector, among the developing and transition economies for which relevant data were available, computer services displayed the highest average annual growth rate between 2010 and 2017, surging by an average rate of 8 per cent. In comparison, manufacturing grew by only 1 per cent, and telecommunications registered no growth (figure III.12). While value added in telecommunications rose in 12 countries and in manufacturing it rose in 14 countries, in computer services it increased in 20 of them.

Figure III.12. Growth rate of value added in ICT, by subsector, selected economies, 2010–2017, or latest available year
(Average as a per cent)



Source: UNCTAD, based on international and national sources (see annex to this chapter).

In measuring the overall digital economy, it should be noted that digital goods and services may be produced outside the ICT sector. For instance, in Malaysia, 3 per cent of ICT goods and services are produced outside that sector. In Mexico, the contribution of value added in computer services to GDP has stagnated at 0.1 per cent over two decades (figure III.13), largely because computer services are produced mainly for internal use by firms outside the ICT sector (Schatan and Enríquez, 2015). Moreover, in some developing countries, the government is a significant producer of computer services.

C. EMPLOYMENT IN THE DIGITAL ECONOMY

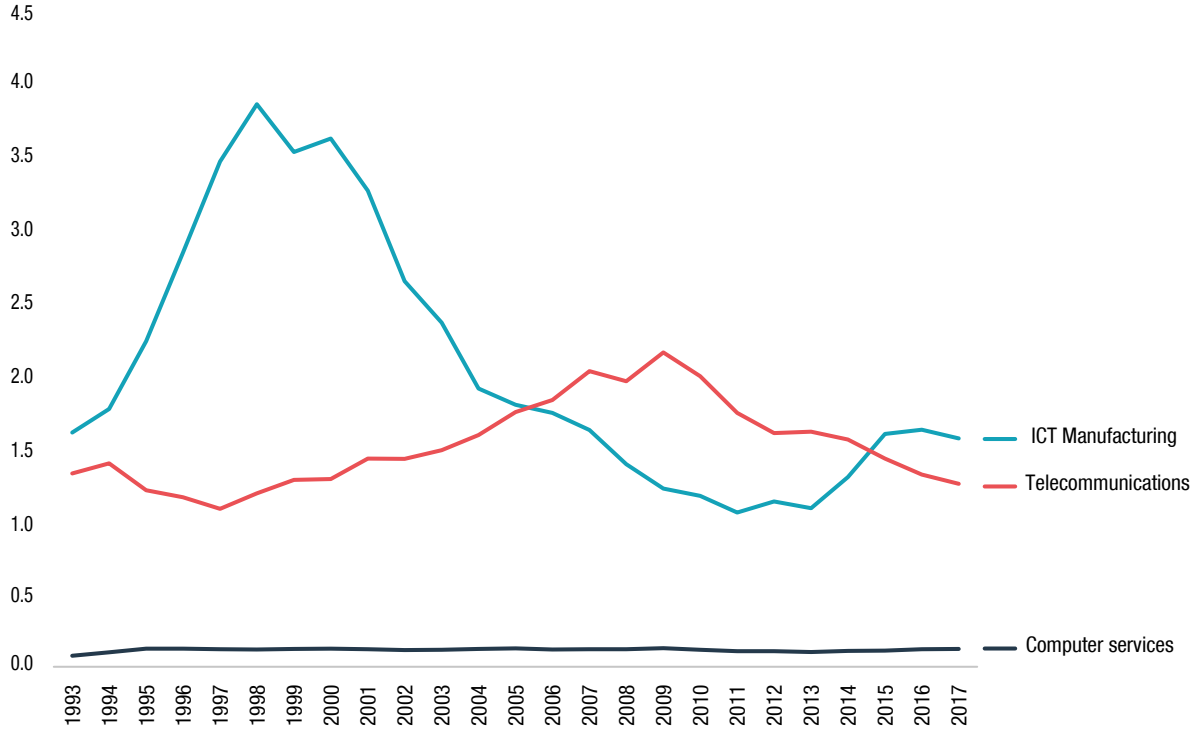
An important dimension of value addition in the digital economy is related to employment. Two aspects are particularly relevant in this context: 1) employment in the ICT sector itself, which corresponds to the core and narrow scope of the digital economy; and 2) employment in ICT occupations in the economy, which is linked to the broad, digitalized economy. However, there is a general shortage of statistics on employment in the digital economy, and detailed occupational data are lacking for most developing countries. Moreover, while data on employment in the ICT sector are more readily available, they capture only part of the impact of digitalization on employment. The analysis in this section draws on statistical data from Eurostat, ILO, OECD, the European Commission's Joint Research Centre Study titled Prospective Insights in ICT R&D (PREDICT), as well as national sources.

1. Employment in the ICT sector

Global employment in the ICT sector grew by 16 per cent between 2010 and 2015, rising from 34 million to 39.3 million employees. As a result, its share in total employment rose from 1.8 per cent to 2 per cent. Employment in computer services grew particularly fast during the same period, by 27 per cent, and accounted for the largest share (38 per cent) of ICT sector employment in 2015, compared with 31 per cent each for telecommunications and ICT manufacturing (figure III.14).

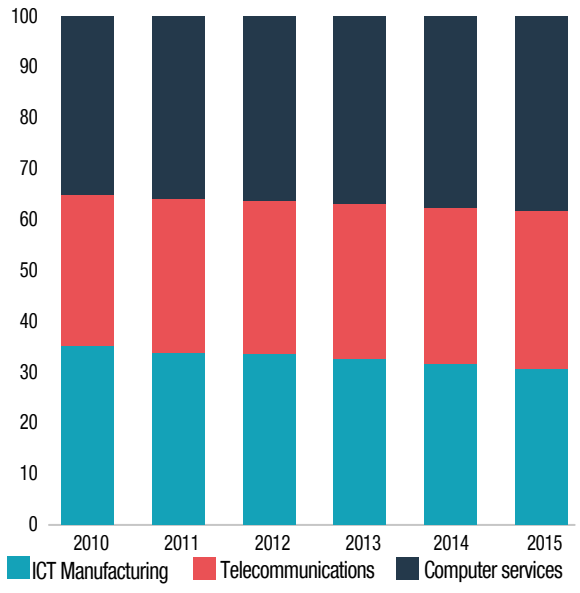
Computer services had the largest share of ICT sector employment in total employment in all but three of the top ten economies (figure III.15). Three of the top ten are developing economies while six are European

Figure III.13. Mexico: ICT subsectors' share of value added in GDP, 1993–2017
(Per cent)



Source: UNCTAD, based on OECD, National accounts at a glance (see annex to this chapter).

Figure III.14. Distribution of global ICT sector employment, by subsector, 2010–2015
(Per cent)

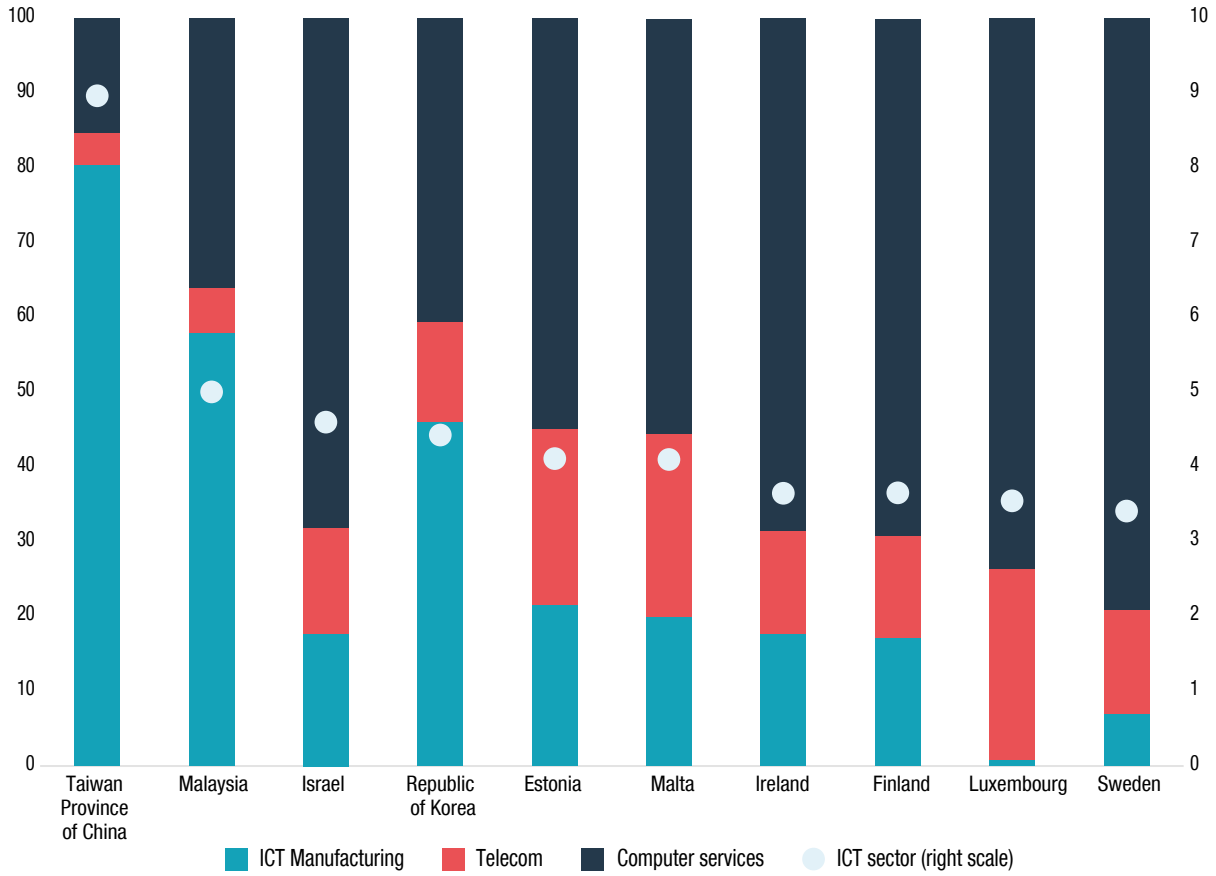


Source: UNCTAD, based on international and national sources (see annex to this chapter).

countries. And ICT sector employment accounted for 2 per cent or less of total employment in the remaining developing and transition economies for which data were available (including Brazil, China, India and the Russian Federation). The one exception was the Republic of Moldova, where the share of computer and information services in total employment rose from 2.3 per cent in 2013 to 2.7 per cent in 2017.

In the ICT sector, computer services tend to have a higher employment rate than the other subsectors. Exceptions include economies in which ICT manufacturing dominates the ICT sector, as seen in the bottom left part of figure III.16. However, many employees in ICT manufacturing are also involved in computer services. For example, while China has a very low proportion of employment in the computer services industry, Huawei, the country's largest ICT manufacturer, employs 80,000 people (or 45 per cent of its total workforce) who are involved in R&D, including software development (Huawei, 2018). Three developing and transition economies – Brazil, India and the Republic of Moldova – reported that more than 50 per cent of ICT sector employees worked in computer services.

Figure III.15. ICT sector employment as a share of total employment and distribution by subsector: Top 10 economies, 2015
(Per cent)



Source: UNCTAD, based on international and national sources (see annex to this chapter).

2. Employment in ICT occupations

ICT occupations exist across entire economies. The ILO 2008 International Standard Classification of Occupations (ISCO-08) identifies over 600 types of jobs, including a number related to digital professions.[51] However, despite the ILO classifications for various ICT occupations, very little data are available; few countries disseminate employment data at this level, although, theoretically, around 100 of them could do so (UNCTAD, 2015a). Eurostat has data on the number of ICT specialists[52] for a few transition economies, but does not seem to have any on the number of ICT occupations by different industries.

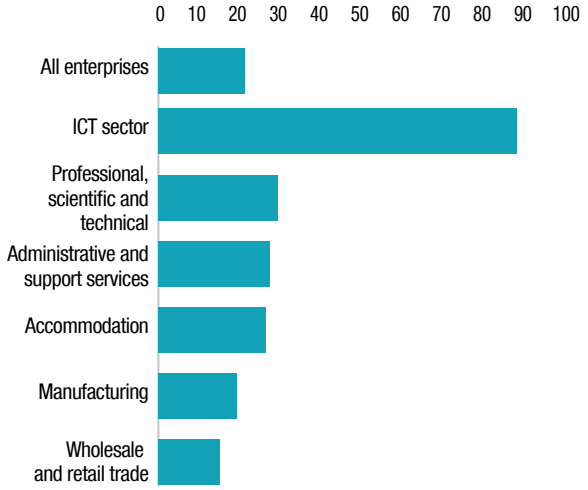
Some countries have data on the number of employed ICT specialists. Serbia, for example, has statistics on the proportion of enterprises that employ ICT specialists (figure III.17). They show that the ICT sector boasts the highest proportion of enterprises with such specialists, but other industries also hire them in varying degrees, reflecting the digitalization of the economy. The country's employment data indicate that there are more ICT specialists than people employed in the ICT sector. Moreover, their share in total employment grew from 2.3 per cent in 2013 to 3.2 per cent in 2017, whereas the share of ICT sector employment only grew from 2.1 percent to 2.5 per cent over the same period.

Figure III.16. Shares of employment in computer services and telecommunication services in total ICT sector employment, selected economies, 2015, or latest available year
(Per cent)

Source: UNCTAD, based on international and national sources (see annex to this chapter).

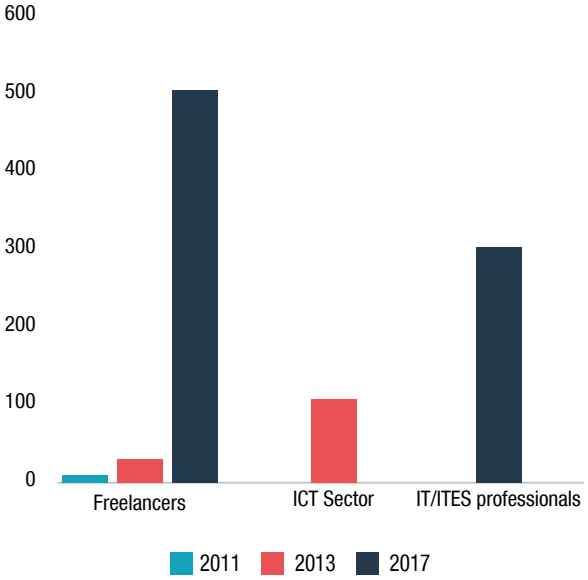
As for many other variables related to the digital economy, challenges to measuring employment in LDCs are particularly acute. For example, in Bangladesh, according to an economic census for 2013 (which provides the latest available data, with results available at 4-digit ISIC codes), just over 10,500 people were working in computer and information services (Bangladesh Bureau of Statistics, 2015). Another report found that there were around 30,000 freelancers in ICT in Bangladesh in 2013, up from some 10,000 in 2011 (Bangladesh Computer Council, Tholons, 2016); and in 2017 there were reportedly as many as half a million regularly working freelancers with annual combined earnings of $100 million.[53] It is not known how freelancers are classified by industry, but clearly they are not all captured as employees in the ICT sector. In addition, the IT industry association in the country reported that there were 300,000 professionals employed in IT and IT-enabled services (ITES) in 2017 (figure III.18).

Figure III.17. Serbia: Share of enterprises that employ ICT specialists, all enterprises and by selected industries, 2018
(Per cent)



Source: Eurostat (https://ec.europa.eu/eurostat/en/web/products-datasets/-/ISOC_SKS_ITSPT and https://ec.europa.eu/eurostat/web/products-datasets/product?code=isoc_ske_itspen2&lang=en); and Statistical Office of the Republic of Serbia (http://data.stat.gov.rs/Home/Result/240203?languageCode=en-US).

Figure III.18. Bangladesh: Estimates of ICT-related employment, selected years
(Thousands)



Source: Bangladesh Bureau of Statistics, 2015; BASIS, 2018.

D. TRADE RELATED TO THE DIGITAL ECONOMY

Some economies have been successful at leveraging trade in ICT goods and services for value creation. This may lead to significant employment opportunities, add value to GDP and generate earnings in foreign exchange. However, apart from the Philippines, few countries have been successful at exporting both ICT goods and services, and some countries (e.g. Costa Rica and Finland) have offset significant declines in goods exports by increasing services exports. Other countries have seized opportunities for trade in so-called ICT-enabled (or digitally delivered) services.

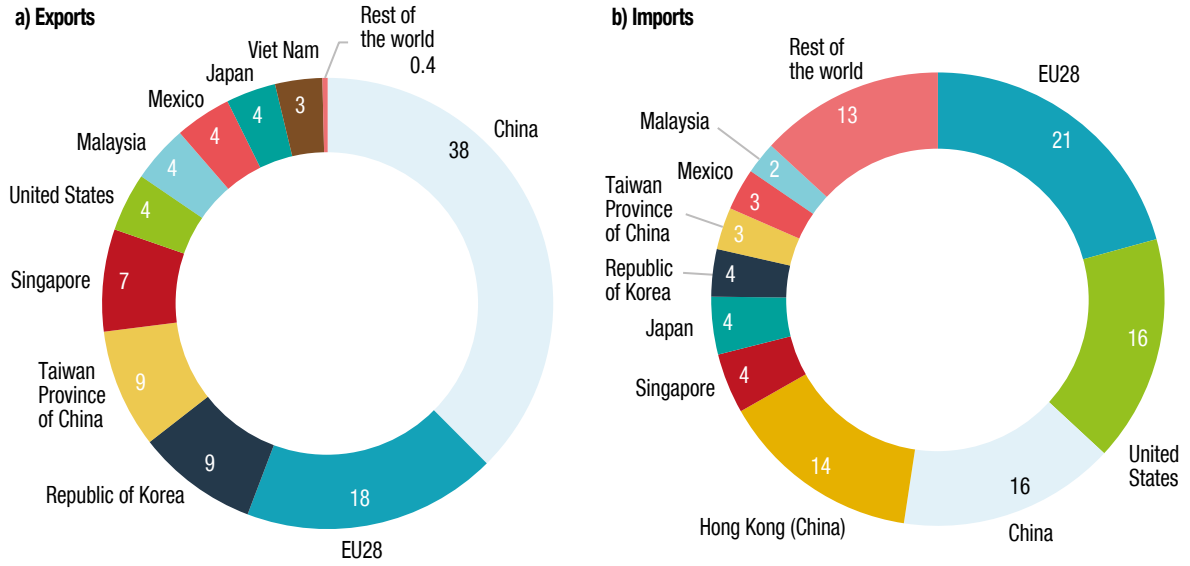
Trade in ICT goods amounts to a substantially higher global value ($1.9 trillion in exports in 2017) than trade in ICT services ($568 billion in exports in 2018), but the latter have proved more resilient in the past decade. Trade in ICT goods is more concentrated geographically than it is in ICT services. Digitalization has made more services tradable by enabling their delivery over ICT networks. New methodologies which now exist for measuring the value of services that are digitally delivered show that they amounted to some $2.9 trillion in 2018 (see section D.3).

1. Trade in ICT goods

Exports of ICT goods are highly concentrated in a few economies. Indeed, the top 10 exporters accounted for 99.6 per cent of the total value of ICT goods exports (figure III.19).[54] Seven of the top ten economies are from East and South-East Asia, China being by far the largest exporter with a 38 per cent share. By comparison, the combined share of the EU and the United States was 22 per cent. The Republic of Korea saw the highest annual growth rate among the top ten exporters, owing mainly to unprecedented growth in IoT since 2015.[55] Mexico was the only non-Asian developing country among the top ten in 2017, mainly due to its exports to North America. About 83 per cent of its office and telecommunications equipment exports were to the United States, while 49 per cent of its imports of ICT goods came from China.

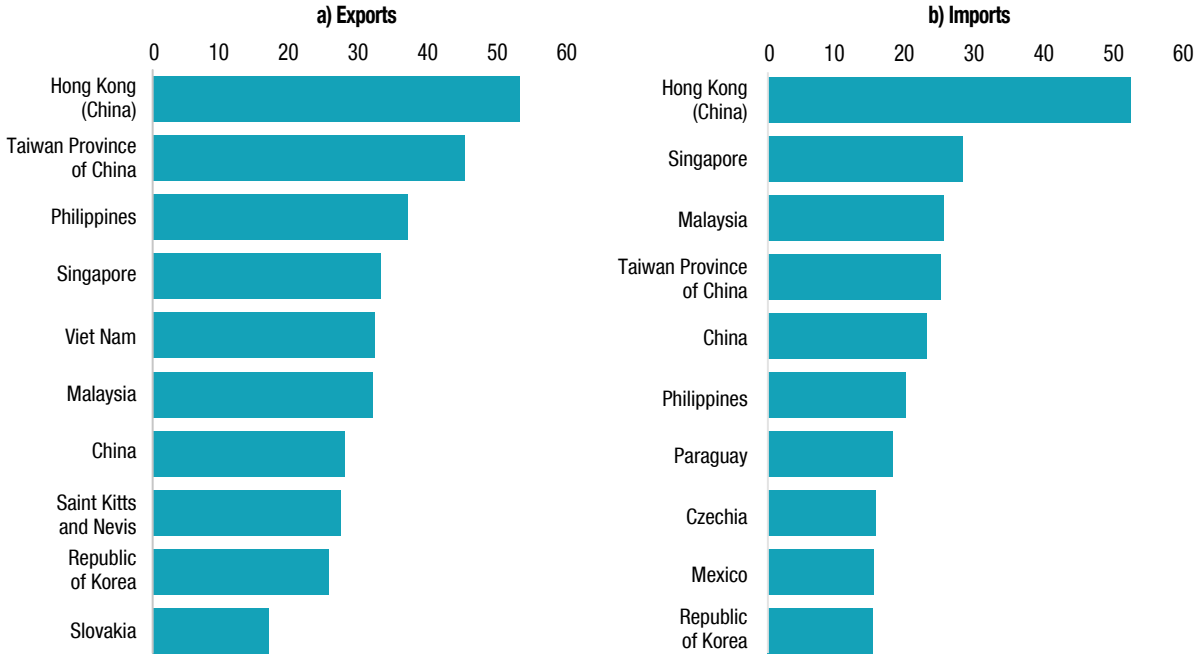
Regarding the share of ICT goods in total merchandise exports, East and South-East Asian economies dominate (figure III.20). In Hong Kong (China), ICT goods account for more than half of all merchandise exports, which are linked to re-exports from mainland China. Viet Nam has emerged as a rising ICT manufacturing centre, with ICT goods constituting almost a third of its merchandise exports, largely due to Samsung's investment in new production plants

Figure III.19. Geographical distribution of trade in ICT goods, 2017
(Per cent)



Source: UNCTADStat.
Note: ICT goods exports are based on goods identified in HS 2017 at the 6-digit level and have been calculated by UNCTAD using COMTRADE data. Data for Viet Nam refers to 2016.

Figure III.20. Share of ICT goods trade in total merchandise trade: Top 10 economies, 2017
(Per cent)



Source: UNCTADStat.
Note: ICT goods exports are based on goods identified in HS 2017 at the 6-digit level, and have been calculated by UNCTAD using COMTRADE data. Data for Viet Nam refer to 2016.

in the country (Sturgeon and Zylberberg, 2016).[56] For some SIDSs, such as Saint Kitts and Nevis, ICT equipment constitutes a significant proportion of their merchandise exports. While almost every developing economy manufactures and exports some type of ICT equipment, it usually involves low-value goods (such as cables or reassembled knock-down kits). Higher value branded devices and telecommunications network gear are produced in just a few economies. In 2017, only 10 economies ran a trade surplus in ICT goods, while 112 reported a deficit.

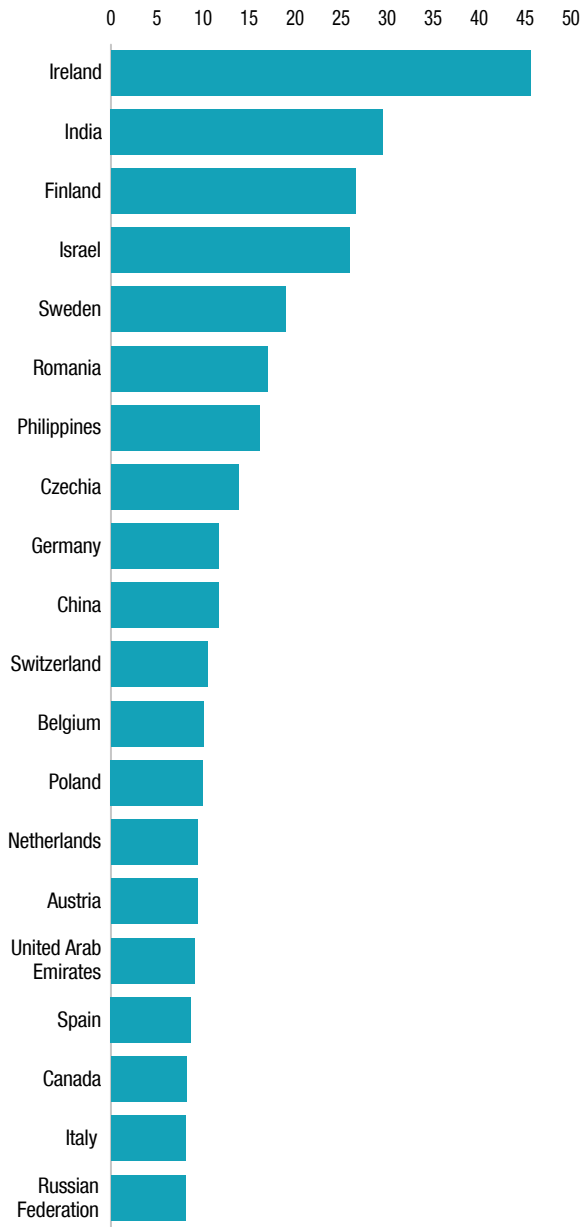
As ICT goods are a key input in various kinds of digitally enabled activities, imports are geographically less concentrated than exports. Together, the top 10 importers in 2017 accounted for 87 per cent of global ICT goods imports, led by the EU, the United States and China. Since the top economies for the share of ICT goods imports in total imports are deeply integrated into ICT supply chains, it is not surprising that electronic components represent a major proportion of their ICT goods imports. Paraguay and Czechia are newcomers among the top 10.

2. Trade in ICT services

Some countries have been successful at developing an export industry in ICT services.[57] Among the top exporters, the relative importance of ICT services in total services exports varies considerably (figure III.21). In Finland, India, Ireland and Israel, this share is higher than 25 per cent. Almost all of Ireland's exports of ICT services are generated from computer services. This is partly a statistical anomaly, reflecting the presence of several multinational digital companies reporting business results in that country (Jacobson, 2018; Stewart, 2016). India, ranked second, is the largest developing-country exporter of such services, almost a third of which are computer services. Finland is third, one of 12 EU countries among the leading ICT service exporters. To some extent, the rise in its ICT services exports has been able to offset its falling ICT goods exports following the downturn of Nokia (Wessman, 2015). The only transition economy included in figure III.21 is the Russian Federation, and the United Arab Emirates is the only West Asian country in the list.

In order to strengthen the capacity to create and capture value in the digital economy, it is increasingly important for a country to develop competitive domestic production of software and IT services. The

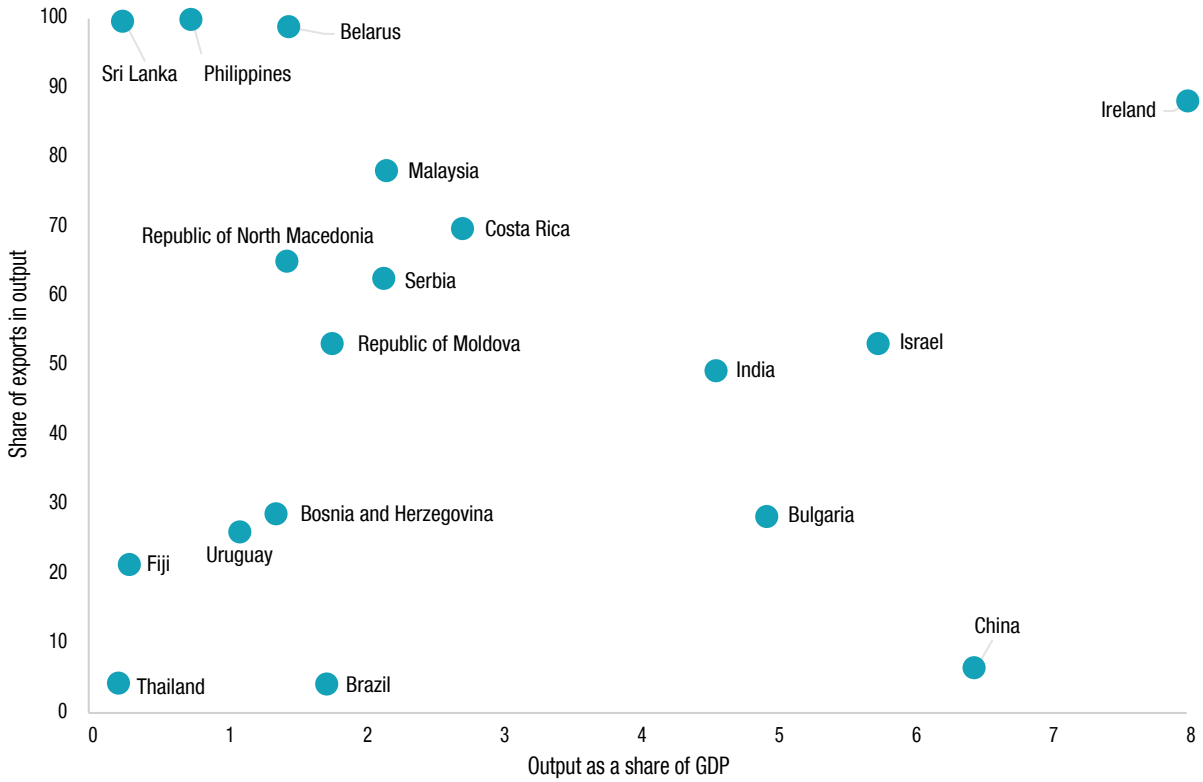
Figure III.21. Share of ICT services in total exports of services: Top 20 countries, 2017
(Per cent)



Source: UNCTADStat.

share of exports of computer services compared with total computer services industry output varies greatly, and reflects different market orientations (figure III.22). Some countries (e.g. the Philippines and Sri Lanka) place a particularly strong emphasis on production for export rather than for their domestic markets. China is notable for having a computer services industry that produces mainly for the domestic market, including

Figure III.22. Computer services: Exports as a share of output, and output relative to GDP, selected countries, 2016 or latest available year
(Per cent)



Source: UNCTAD, based on data from WTO for computer services exports; and Eurostat and national statistical offices for computer services output.
Note: "Output" refers to production/sales. Data refer to 2016 except for Thailand and Sri Lanka (2013); Malaysia, Fiji and Uruguay (2014); and the Philippines, Belarus and Serbia (2015). Data for Ireland were adjusted for inclusion in the figure, as computer services output for Ireland as a share of GDP was 28 per cent.

for manufacturing companies that often embed software in their exports of manufactured products (UNCTAD, 2012a). The computer services industry in India is increasingly catering to the domestic market, leveraging expertise gained from exporting while at the same time reducing an over-reliance on such exports.

3. Trade in digitally delivered services

With telecommunications and computer services becoming more easily available and affordable (see chapter I), more services are increasingly tradable and possible to deliver remotely. This has given rise to an expansion of the outsourcing and offshoring of a range of business services (such as marketing and management consulting), and has lowered barriers and entry costs for businesses in developing countries to produce and export such services.

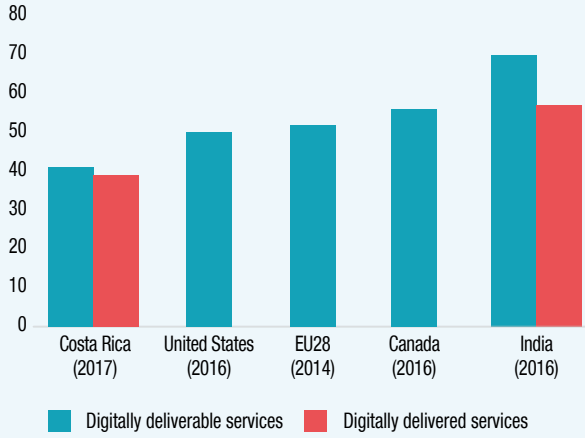
Digitally delivered or ICT-enabled services are defined as services delivered remotely over ICT networks (UNCTAD, 2015b). The size and composition of services that are *actually* delivered in this way are hard to measure with existing methodologies and survey vehicles.[58] The lack of such data constitutes a significant gap in the toolkit governments need to design and implement relevant policies. However, official statistics can be used to estimate the value of exports of those services that could *potentially* be delivered digitally, sometimes called "digitally *deliverable*" services (Grimm, 2016). They include insurance and pension services, financial services, charges for the use of intellectual property, telecommunications, computer and information services, other business services, and audiovisual and related services (box III.1).

In 2018, exports of digitally deliverable services amounted to $2.9 trillion, or 50 per cent of global

Box III.1. UNCTAD pilot surveys for measuring digitally delivered services

To enable countries to collect internationally comparable statistics on digitally delivered trade in services, UNCTAD has developed a definition and a corresponding methodology (UNCTAD, 2018d). During 2017, UNCTAD piloted a new model survey questionnaire in three countries: Costa Rica, India and Thailand. Results are available for Costa Rica and India for both "digitally deliverable" and digitally delivered services (ICT-enabled services). In Thailand the survey was implemented in the telecommunications sector only. Costa Rica has followed up with a second survey for 2017 (Banco Central de Costa Rica, 2019).

Box figure. Digitally deliverable and digitally delivered services as a share of services exports, selected countries and the EU28, latest available year
(Per cent)



In Costa Rica, digitally deliverable services represented 41 per cent of total exports of services in 2017 (box figure). Almost all (95 per cent) of the digitally deliverable services were found to have been digitally delivered. Most of these exports were by large foreign-owned enterprises that were providing management, administrative and back-office services to the United States. Meanwhile, micro and small enterprises accounted for 7.5 per cent of the total exports of digitally delivered services. The workforce of the companies exporting services via ICT networks comprised 58 per cent men and 42 per cent women.

In India, 70 per cent of the total services exports were digitally deliverable in 2016. In their case, 81 per cent were digitally delivered, while the remainder were being exported via the dispatch of ICT experts from India to the destination market. Thus, 57 per cent of India's total exports of services were digitally delivered. Computer services were the biggest contributor, representing almost two thirds of the total amount. For services-exporting SMEs, delivery over ICT networks constituted the predominant mode of supply (more than 99 per cent), while for larger enterprises, many complemented remote ICT delivery with other modes of supply, notably sending experts to provide the services on-site (DGCIS, 2018).

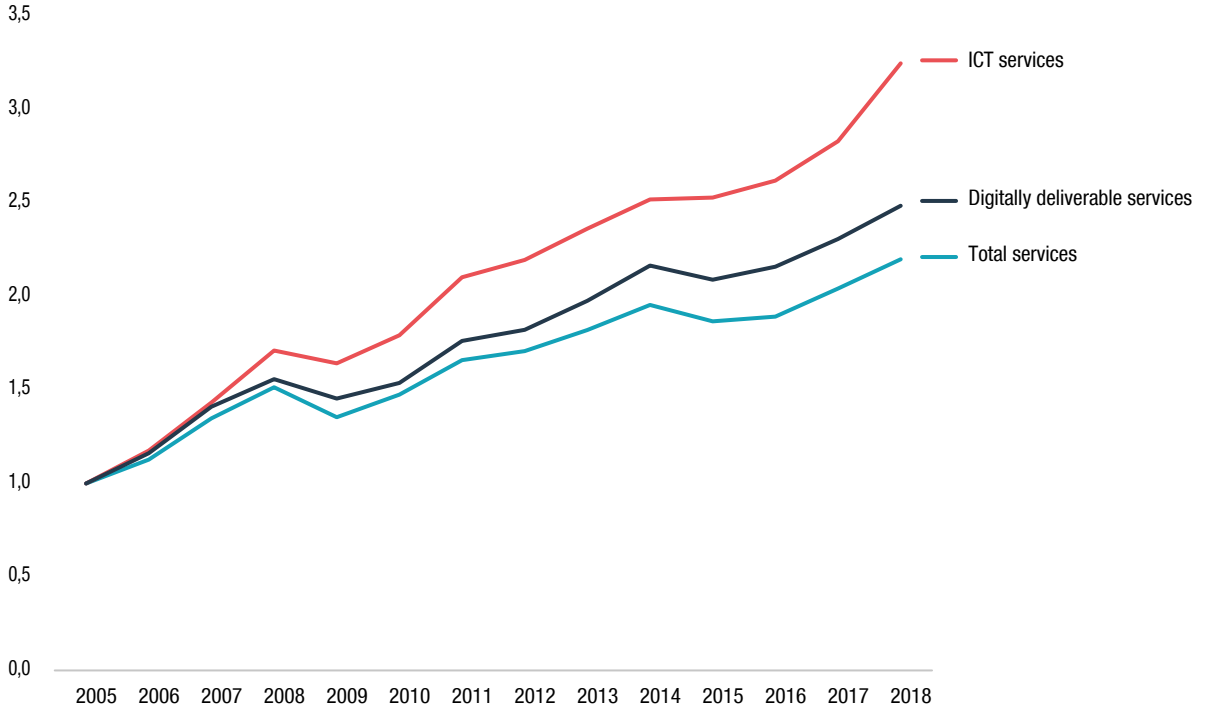
Note: For India the reference period of the survey was April 2016 to March 2017.
Source: UNCTAD, based on Indian DG of Commercial Intelligence and Statistics, Costa Rica Central Bank, United States BEA, United States Department of Commerce and Statistics Canada.

services exports. Over the period 2005–2018, they grew at a rate of 7 per cent annually, as compared to 6 per cent, on average, for all services exports (figure III.23). The faster growth of exports of ICT services and digitally deliverable services in comparison with total services exports is an illustration of the increasing digitalization of an economy. Business services exports are by far the largest category, with a global value of $1.2 trillion.[59]

Exports of digitally deliverable services increased substantially across all regions during the period 2005–2018, with a compound annual growth rate ranging between 6 and 12 per cent (table III.1). This growth was the highest in developing countries, especially in Asia. Developed economies accounted for more than three quarters (76 per cent) of exports of such services. Their share was particularly high (80–90 per cent) with respect to charges for the use of intellectual property, financial services and audiovisual and related services. In developing countries, telecommunications, computer and information services constituted the largest share of digitally deliverable services (at 30 per cent). In LDCs, those services accounted for 16 per cent of all their services exports, and they more than tripled from 2005 to 2018, albeit from a very low level. In Africa, the transition economies, West Asia, as well as Latin America and the Caribbean, exports of digitally deliverable services have been growing as well, but they have remained significantly lower than in the other regions.

In the United States, digitally deliverable services represented a little over half of the country's exports of all services in 2016 (Grimm, 2016).[60] In the EU, a similar study for 2014 found that the corresponding share was about 52 per cent, including intra-EU trade, and 56 per cent excluding intra-EU trade (Nicholson, 2016).

Figure III.23. Global exports of digitally deliverable services, ICT services and total services, 2005–2018
(Index numbers, 2005=1)



Source: UNCTADStat.

Table III.1. Exports of digitally deliverable services, by region and by level of development, 2005 and 2018
($ million)

Region	2005	2018	Compound annual growth rate 2005–2018 (per cent)
World	1 179 430	2 931 400	7
Developed economies	989 320	2 232 100	6
Developing economies	178 030	659 870	11
Africa	10 860	26 790	7
Asia and Oceania	145 150	575 920	11
East Asia	97 130	341 570	10
South Asia	39 260	140 310	10
South-East Asia	37 310	161 330	12
West Asia	25 340	73 860	9
Latin America and the Caribbean	22 030	57 160	8
Transition economies	12 080	39 430	10
LDCs	2 100	7 460	10

Source: UNCTADStat.

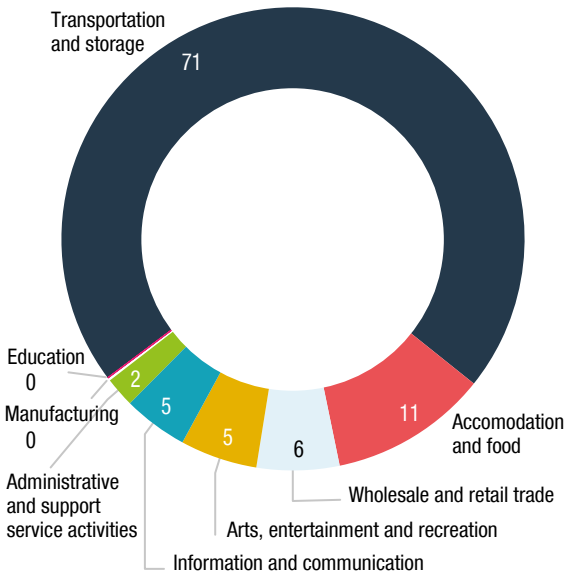
E. VALUE ADDED IN E-COMMERCE

Beyond the global analysis of the recent evolution of e-commerce sales (provided in chapter I), an assessment of value emerging from e-commerce should, ideally, use value-added data. While detailed information beyond broad figures for e-commerce revenue is primarily collected only by developed economies, this is slowly starting to change, with some developing countries providing more statistics. Available studies suggest that travel accounts for the bulk of B2C e-commerce in many developing countries.[61] For example, data from the Philippines suggest that transportation and storage accounted for 71 per cent of turnover from e-commerce in 2015 (no breakdown by type was available), likely from online purchases of travel services (figure III.24). Accommodation and food services, which were the second largest source of e-commerce revenue, were also connected to travel-related activities and food ordering. Meanwhile, wholesale and retail trade represented 6 per cent of e-commerce sales in 2015.

E-commerce is usually reported as total sales, while some companies report only revenue from transactions. A value-added measure would show the contribution to the economy, which, combined with value added in the ICT sector, would offer a broader picture of value in the digital economy. A few countries have begun to report statistics on value added in e-commerce. In Mexico, for example, rather than a breakdown by B2B or B2C, e-commerce value added data are provided for retail and wholesale trade, with a single aggregate for all other service industries. Online retail trade, the narrowest measure of B2C, accounted for a little over a fifth of e-commerce value added in 2016 (or 0.9 per cent of GDP), wholesale trade for 29 per cent and other service industries for around 50 per cent. In terms of value added, e-commerce contributes a higher share of GDP than does the ICT sector in Mexico.[62] Moreover, e-commerce increased its share of GDP by one percentage point between 2013 and 2016, while the share of ICT services stagnated.

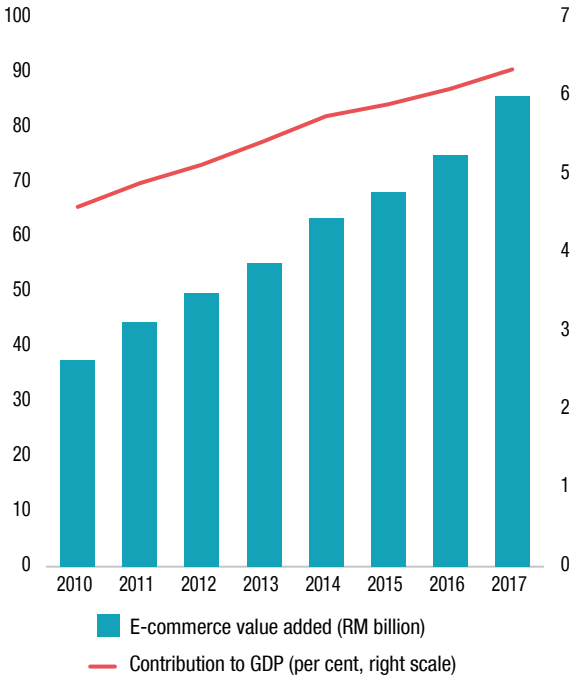
In Malaysia, there has been a notable uptake in e-commerce, with some 47,556 establishments (or 5 per cent of all establishments) engaged in this activity in 2015. About 5,510 of the establishments (i.e. 12 per cent of the total) carrying out e-commerce were owned by women. E-commerce sales amounted to 398 billion

Figure III.24. Philippines: E-commerce sales by sector, 2015
(Per cent)



Source: UNCTAD, based on Philippine Statistics Authority, 2015.

Figure III.25. Malaysia: Value added of e-commerce, and its contribution to GDP, 2010–2017



Source: UNCTAD, based on Malaysia Department of Statistics.
Note: The value added of e-commerce is in Malaysian ringgits.

Malaysian ringgits (or $102 billion). Women-owned businesses accounted for 2 per cent of these sales. In Malaysia, which is one of only a few countries to calculate value-added in e-commerce, the contribution of e-commerce value added to GDP grew from 4.6 per cent in 2010 to 6.3 per cent in 2017 (figure III.25).

F. COMPREHENSIVE MEASUREMENT OF THE DIGITAL ECONOMY: SOME EXAMPLES

1. Accounting for digital spillover effects

In the context of measuring the digital economy, a study by Huawei and Oxford Economics (2017) goes beyond conventional metrics to capture potential positive spillover effects from digital investment of companies, which would multiply the impact on the overall economy. The model assesses both direct effects, mainly in the form of productivity increases, and indirect effects related to spillovers. The latter are based on three main channels: 1) internal channels, through learning by doing (i.e. how companies can amplify their initial gains as they learn more about how to leverage technology across departments); 2) horizontal channels, or competition effects (with innovations by one company being emulated by others, leading to productivity gains across the sector); and 3) vertical channels or supply chain effects (as productivity gains achieved in the delivery of digital goods and services are passed down the supply chain from primary producers to end users).

The study estimates that the global digital economy was worth $11.5 trillion in 2016, or 15.5 per cent of global GDP – 18.4 per cent of GDP in developed economies and 10 per cent in developing economies, on average. It found that the digital economy had grown two and a half times faster than global GDP over the previous 15 years, almost doubling in size since 2000. Most of the value in the digital economy was produced in only a few economies: the United States (35 per cent), China (13 per cent) and Japan (8 per cent). The EU together with Iceland, Liechtenstein and Norway accounted for another 25 per cent. The share of China more than trebled from 4 per cent in 2000, and India's share doubled to 2 per cent.

While it is an interesting approach to consider both direct and indirect effects of the digital economy in the overall economy, this appears to be the only study at the global level. More research would be welcome to validate the results of this assessment.

2. National initiatives to estimate the value of the digital economy

As mentioned earlier (section III.A), probably the most significant attempt at measuring the digital economy at the national level has been undertaken by the BEA in the United States, which started using satellite accounts to this end in 2018 (Barefoot et al., 2018). An update of these estimates (BEA, 2019). found that the digital economy accounted for 6.9 per cent of current GDP in 2017, up from 5.9 percent in 1997. Real value added in the digital economy grew at an average annual rate of 9.9 per cent during this period, compared to 2.3 per cent for the overall economy. Thus, the digital economy in the United States consistently contributed more to economic growth than its share in the economy; and in 2017, it supported an estimated 5.1 million jobs, or 3.3 per cent of total employment.

The Australian Bureau of Statistics estimates that the share of value added in digital activity in aggregate total value added increased from 5.4 per cent in 2011–2012 to 5.7 per cent in 2016–2017 (ABS, 2019).

Measures of the digital economy very much depend on the definition used. The IMF (2019b) notes that, using the narrow OECD definition (which refers only to the ICT sector), the digital economy in China accounted for 6 per cent of GDP in 2017. Using a broader definition, which includes both the ICT sector and parts of traditional sectors that have adopted digital technology, the same study cites estimations by the China Academy of Information and Communication Technology, according to which the digital economy could be contributing as much as 30 per cent to GDP (see also Miura, 2018).

These scant and dispersed estimates on the size of the digital economy in a few countries serve to illustrate the difficulties of measuring the digital economy holistically. Indeed, given that it is practically impossible to provide any quantitative assessment of that economy – especially in a way that allows international comparisons – it also prevents an overall assessment of value in it. Differences in definitions and methodologies point to the need for more standardization in the measurement in the digital economy at the international level.

G. EVIDENCE OF THE VALUE OF THE DATA MARKET

Given that the world is at early stages of digitalization, the dynamics of the data-driven economy are still poorly understood, and production, supply of and demand for data remain unclearly defined. Consequently, quantifying the size of the data market is also difficult. This brief section looks at two examples of possible ways to measure the value of the data market in Europe and the possible economic impact of data centres.

The European Data Market Monitoring Tool is an attempt to quantify the data market and its contribution to the economy of the EU, but also it enables some international comparisons with selected countries (Brazil, Japan and the United States) (table III.2). According to a study based on the Monitoring Tool, the United States is the leader in the data market with more than 14 million data professionals, more than 300,000 data companies, and a data market value of more than €145 billion. Japan registers the highest incidence of the data market economy in GDP and Brazil the lowest. The value of the overall data economy in the EU (including direct and indirect impacts plus induced effects) increased from €246.8 billion in 2013 to €335.6 billion in 2017, which represented a contribution to the EU's GDP of 2.4 per cent (IDC and Lisbon Council, 2018; IDC, 2016).

Data centres can have significant economic impacts by generating spillover effects with the rest of the economy. RTI International (2018) estimates that Facebook's data centres alone contributed a cumulative $5.8 billion to the GDP of the United States and employed 60,100 people in that country during the period 2010–2016. And Oxford Economics (2018) found that Google's data centres in 2016 generated $1.3 billion in economic activity, $750 million in labour income, and 11,000 jobs in the United States. In Europe, it has been estimated that Google's investments in data centres added, on average, some €490 million per year to the EU's GDP for the period 2007–2017 and supported 6,600 jobs per year (Copenhagen Economics, 2018).

With growing demand for cloud-based services, as well as surging data traffic, the creation of data centres has been increasing rapidly. However, as shown in chapter I, their geographical location remains strongly concentrated in developed countries. More studies are needed on the impact of data centres on local economies in developing countries. Whereas those centres tend to employ relatively few people, having data stored close to the market means less reliance on international bandwidth, and possibilities for a more sustainable national data infrastructure.[63] Further research is needed to compare the impacts of data centres on GDP and employment between developed countries and developing countries.

H. CONCLUSIONS

In the absence of an internationally agreed definition of the digital economy, and of standardized methodologies to measure it, assessments of value within that economy must be based on partial national and sectoral statistical data. The sparsity of statistical data is problematic for various reasons. Importantly, given the broad reach and scope of the digital economy, which affects all sectors of countries' economies, any assessment would require a systematic analysis of multiple and connected variables. The paucity of data also hampers international comparisons. Several initiatives to remedy this situation are under way at the international and regional levels. However, they

Table III.2. Monitoring the data market, selected economies, 2017

	Number of data professionals (thousands)	Number of data companies	Value of the data market (millions of euros)	Value of the data economy (millions of euros)		Incidence of data economy on GDP (per cent)
				Direct impact	Indirect impact	
Brazil	1 176	36 387	6 310	6 395	298	0.16
European Union	7 290	276 450	65 038	65 038	3 303	0.52
Japan	4 040	104 664	27 723	29 949	1 269	0.95
United States	14 012	302 810	145 546	113 677	7 766	0.81

Source: IDC and Lisbon Council, 2018 (http://datalandscape.eu/european-data-market-monitoring-tool-2018).

remain insufficient, and are unable to cope with the rapid evolution and global implications of the digital economy; more needs to be done to enable better measurement of that economy. This should include dedicated support to low-income countries to improve their statistical capacities to produce relevant information.

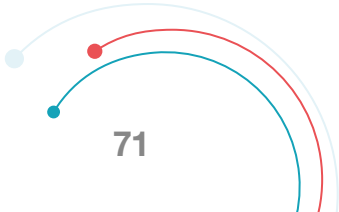
This chapter has presented some evidence of opportunities for value addition, employment and trade relating to the ICT sector, ICT occupations and e-commerce. It covers mainly the core and narrow scopes of the digital economy and less so the broad scope. It has found that value added in ICT manufacturing is highly concentrated in East Asia in general, and the scope for more developing countries to extract value from this sector is likely to be quite limited. Computer and information services is the only subsector that is growing across all regions and employs a relatively large number of people. Policymakers may wish to consider ways to leverage this sector for value creation (chapter VI).

Some recent studies seeking to capture spillover effects from the digital economy and the impact of digitalization on broader segments of the economy point to much greater effects than those indicated from a narrow analysis of the digital economy.

As digital data are becoming an increasingly important resource in economies, an additional major issue to consider in connection with measuring value in the digital economy is the scarcity of statistical data on variables relating to digital data. While some evidence has been presented above on the value of the data market in the European economy, and on the opportunities provided by data centres, most of the data relating to data traffic, cross-border data flows, data centres and cloud-related variables are in the hands of the private sector. This is becoming a growing concern. Any analysis on the data-driven digital economy will require proper assessments of the evolution of such data. Without appropriate evidence, it will be difficult for policymakers to address adequately the opportunities and challenges associated with digital-data-driven development.

While this chapter has highlighted several difficulties in measuring the impact of the data-driven economy, technological advances may help improve statistical measurement processes. New technologies enable the collection and analysis of data in ways that were not possible before. They also facilitate measurement of the relevant indicators. This can be useful for different policy areas, as well as for measuring the attainment of economic, social and environmental goals.

The quantitative analysis in this chapter complements the qualitative analysis of value creation and capture in the digital economy presented in the next two chapters. Those chapters also use available empirical evidence on topics of relevance, such as the role of global digital platforms in the advertising market, taxation in the digital economy and platform work.

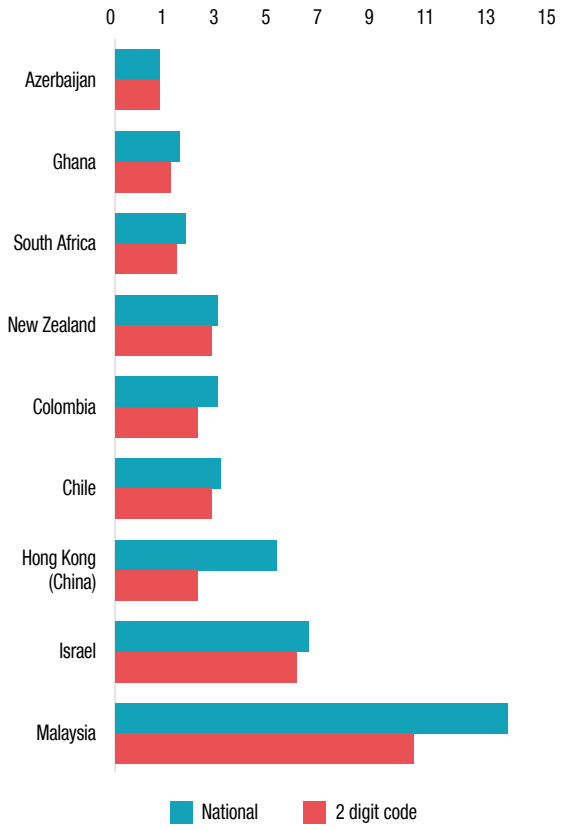


ANNEX TO CHAPTER III

The data set presented by the European Commission's Science Hub, titled Prospective insights on R&D in ICT (PREDICT) features ICT sector value added and employment data for 40 economies for the period 1995–2017. For some non-EU countries, value added data are only available up to 2015. Total employment figures are available through 2015. The PREDICT data do not exactly conform with the official ICT sector definition (see annex table III.1, which uses the Philippines as an example). Specifically, one three-digit manufacturing item is excluded as is wholesale trade.

Ten developing economies compile data on the ICT sector through special ICT satellite accounts or through aggregation of the appropriate International Standard Industrial Classification (ISIC) codes. A far larger group of mainly developing countries could be included by mapping the ICT sector using two-digit ISIC codes, since ICT sector data are available at this level for these economies from Eurostat, OECD and national statistical offices. Use of two-digit ISIC codes results in a slightly expanded scope of ICT manufacturing,[64] excludes ICT trade industries (as does the PREDICT data set), omits software publishing and repair, and includes both divisions of Division 63 (annex table III.1). Given that the excluded industries tend to be either small overall or small in developing countries, the two-digit definition still provides a good approximation of the ICT sector and would allow the inclusion of another 19 economies in the analysis.

Annexe Figure III.1. Share of ICT sector value added in GDP: Differences between national ICT sector and ISIC two-digit definitions, selected countries, 2016 or latest available year
(Per cent)



Source: ITU World Telecommunication/ICT Indicators database.

The two-digit structure also enables greater comparability, since some economies that report ICT sector data include industries not in the formal alternative aggregation for the ICT sector. This typically includes content and media industries. In general, the differences are not significant with the two-digit structure (annex figure III.1). In the case of Hong Kong (China), and to a lesser extent in Malaysia, wholesale trade accounts for a sizeable proportion of the ICT sector. However, trade is not included in the PREDICT data set or at the two-digit ISIC level.

Given that few economies publish time series, the compilation of the data requires reviewing reports for each year. Data coverage is from 2010 onwards. Some economies publish only sporadically, either with some delay or only as a one-off publication. In addition, value added for the ICT sector is often available for some economies but not employment and vice versa.

Value added is in current prices converted to United States dollars using annual average exchange rates. Exchange rates along with GDP data are sourced from the World Bank (https://data.worldbank.org/indicator/PA.NUS.FCRF and https://data.worldbank.org/indicator/NY.GDP.MKTP.CD).

The full list of economies and data sources is presented below in annex tables III.2 and III.3 and in the statistical sources.

Annex table III.1. ICT sector value added and employment, by different statistical classifications: Example of the Philippines, 2015

ISIC 4.0	Philippines 2015	ICT Sector		PREDICT		2-digit ISIC	
		Total persons employed (Thousands)	Value Added (Millions of pesos)	Total persons employed (Thousands)	Value Added (Millions of pesos)	Total persons employed (Thousands)	Value Added (Millions of pesos)
	TOTAL NATIONAL	38 741	13 322	38 741	13 322	38 741	13 322
	ICT sector share (per cent)	1.0	3.0	0.9	2.9	1.0	3.0
	TOTAL	376	401	362	392	375	398
	ICT MANUFACTURING INDUSTRIES	242	194	242	194	259	201
26	Manufacture of computer, electronic & optical products					259	201
261	Electronic components & boards	151	134	151	134		
262	Computers & peripheral equipment	73	44	73	44		
263	Communication Equipment	5	1	5	1		
264	Consumer electronics	13	15	13	15		
268	Magnetic & optical media	S	S	S	S		
	ICT TRADE INDUSTRIES	14	9				
4651	Wholesale of computers, computer peripheral equipment and software	9	6				
4652	Wholesale of electronic and telecommunications equipment and parts	5	3				
	ICT SERVICES INDUSTRIES	120	198	120	198	116	197
582	Software publishing	2	2	2	2		
61	Telecommunications	39	140	39	140	39	140
62	Computer programming, consultancy and related activities	58	47	58	47	58	47
63	Information service activities					19	9
631	Data processing, hosting and related activities; web portals	19	7	19	7		
951	Repair of computers and communication equipment	2	0.8	2	0.8		
9511	Repair of computers and peripheral equipment	1.6	0.8				
9512	Repair of communication equipment	0.6	0.1				

Note: S = Suppressed for reasons of confidentiality.
Source: See statistical sources below.

Annex table III.2. ICT sector value added as a share of GDP, 2010–2017
(Per cent)

Economy	2010	2011	2012	2013	2014	2015	2016	2017	Notes
Australia	3.5	3.5	3.4	3.1	3.2	2.9	3.2		PREDICT
Austria	2.8	2.9	2.9	2.9	3.0	3.0	3.0	3.0	PREDICT
Azerbaijan†	1.7	1.4	1.5	1.6	1.6	1.8	1.5		2-digit ISIC from national source
Belarus†		2.9	3.3	3.1	3.0	3.5	4.5		National definition
Belgium	3.4	3.3	3.3	3.2	3.1	3.2	3.2	3.2	PREDICT
Bosnia and Herzegovina	4.1	4.2	4.2	4.2	4.2	4.1	3.9		2-digit ISIC from Eurostat
Brazil	3.2	3.0	3.0	2.9	2.8	2.7			PREDICT
Bulgaria	4.0	4.4	4.2	4.5	4.5	4.1	4.0	3.8	PREDICT
Canada	3.7	3.7	3.6	3.6	3.6	3.6	3.6	3.4	PREDICT
Chile†							3.3		2-digit ISIC from national source
China	4.7	4.6	4.7	4.7	4.9	4.8			PREDICT
Colombia†					3.0	3.0	2.8	2.8	2-digit ISIC
Costa Rica	4.0	4.2	4.3	4.3	4.5	4.1	4.2		2-digit ISIC from OECD
Croatia	3.9	3.6	3.5	3.5	3.4	3.5	3.4	3.4	PREDICT
Cyprus	2.6	2.6	2.7	3.4	3.8	3.9	3.9	3.8	PREDICT
Czechia	4.9	4.8	4.7	4.5	4.7	4.7	4.7	4.7	PREDICT
Denmark	3.4	3.3	3.1	3.3	3.1	3.2	3.3	3.1	PREDICT
Estonia	4.6	4.8	4.6	4.6	4.7	4.6	4.6	4.5	PREDICT
Fiji	5.2		4.4	4.1	3.8				2-digit ISIC from national source
Finland	6.1	5.1	3.2	4.7	5.0	4.7	4.3	4.3	PREDICT
France	4.3	4.2	4.1	4.0	4.0	4.0	4.1	4.1	PREDICT
Germany	3.4	3.5	3.5	3.7	3.7	3.8	3.8	3.8	PREDICT
Ghana†	2.7	2.4	2.4	2.2	1.9				2-digit ISIC from national source
Greece	2.9	2.7	2.5	2.9	2.8	2.8	2.9	2.9	PREDICT
Hong Kong (China)	2.2	2.3	2.5	2.7	2.8	2.7	2.8		2-digit ISIC from national source
Hungary	4.7	5.2	4.9	5.0	4.9	4.9	4.7	4.4	PREDICT
Iceland	2.4	2.9	2.9	3.5	3.4	3.6	3.7	3.5	2 Digit ISIC from Eurostat
India	4.0	4.2	4.3	4.8	4.8	5.1			PREDICT
Ireland	9.4	9.1	9.8	9.9	10.4				PREDICT
Israel†	8.2	7.4				6.5	6.2		2-digit ISIC from national source
Italy	3.5	3.4	3.4	3.2	3.1	3.1	3.1	3.1	PREDICT
Japan	6.3	6.2	5.8	5.8	5.9	5.8	5.7		PREDICT
Rep. of Korea	9.2	9.1	9.0	9.2	8.9	8.7	8.4	8.4	PREDICT
Latvia	3.7	3.5	3.6	3.8	3.6	4.1	4.1	4.1	PREDICT

Economy	2010	2011	2012	2013	2014	2015	2016	2017	Notes
Lithuania	3.1	2.6	2.5	2.6	2.6	2.9	3.0	2.8	PREDICT
Luxembourg	5.3	5.3	5.5	4.8	4.9	5.5	5.6	5.6	PREDICT
Rep. of North Macedonia	3.3	3.0	3.0	2.8	2.6	2.6	2.8		2-digit ISIC from Eurostat
Malaysia†	9.8	8.9	8.8	9.2	9.4	10.0	10.2		2-digit ISIC from national source
Malta	6.6	7.3	7.1	5.5	6.0	5.7	5.8	5.8	PREDICT
Mauritius†	5.6	5.0	5.0	4.9	5.0	5.2	5.1		National definition
Mexico	3.2	2.9	2.8	2.8	2.9	3.0	2.9		2-digit ISIC from OECD
Rep. of Moldova						4.4			2 digit ISIC from national source
Netherlands	3.9	3.9	3.8	3.8	3.9	4.0	4.0	4.0	PREDICT
New Zealand†	3.6	3.6	3.6	3.4	3.4	3.3			2-digit ISIC from national source
Norway	3.0	2.9	2.9	2.9	2.9	3.1			PREDICT
Peru	1.9	1.7	1.7	1.7	1.7				2-digit ISIC from OECD
Philippines				3.7	3.2	4.5			2-digit ISIC from national source
Poland	2.9	2.8	3.0	3.1	3.2	3.3	3.5	3.5	PREDICT
Portugal	2.9	3.0	3.0	2.8	2.8	2.8	2.7	2.6	PREDICT
Qatar	1.0	0.8	1.0	1.0	0.9	1.3			2-digit ISIC from national source
Romania	5.3	5.0	4.2	5.2	4.9	5.0	5.0	4.8	PREDICT
Russian Federation	2.4	2.1	2.2	2.2	2.2	2.1			PREDICT
Serbia	3.7	3.8	3.9	3.8	3.9	4.2			2-digit ISIC from Eurostat
Singapore	9.7	8.3	8.1	8.1	8.3	8.2	7.4	9.0	2-digit ISIC from national source
Slovakia	4.5	4.4	4.5	4.2	4.1	4.0	4.0	3.8	PREDICT
Slovenia	3.4	3.3	3.4	3.4	3.4	3.5	3.5	3.5	PREDICT
South Africa†				2.1	2.1				2-digit ISIC from national source
Spain	3.4	3.4	3.5	3.5	3.5	3.3	3.1	3.0	PREDICT
Sri Lanka						0.7			2-digit ISIC from national source
Saint Lucia	5.2	4.7	4.6	4.1	3.9	3.9			2-digit ISIC from national source
Sweden	5.7	5.7	5.5	5.7	5.9	5.9	5.7	5.6	PREDICT
Switzerland	4.1	4.1	4.1	4.1	4.0	4.2			PREDICT
Taiwan Province of China	14.2	14.1	14.3	14.8	16.2	15.9	16.2	16.3	PREDICT
Thailand	6.0	5.0	4.6	4.5	4.8	4.7	4.3		2-digit ISIC from national source
United Kingdom	4.0	4.2	4.1	4.2	4.2	4.2	4.2	4.1	PREDICT
United States	5.3	5.2	5.1	5.3	5.1	5.2	5.2	5.0	PREDICT
Uruguay	2.4	2.4	2.4	2.3	2.2				2-digit ISIC from national source
MEDIAN	3.9	3.8	3.6	3.8	3.7	4.0	4.0	3.8	

Note: † National definitions of ICT Sector.

Annex table III.3. ICT sector employment as a share of total employment, 2010–2017
(Per cent)

Economy	2010	2011	2012	2013	2014	2015	2016	2017	Notes
Australia	2.3	2.3	2.4	2.4	2.6	2.5			PREDICT
Austria	2.1	2.2	2.2	2.3	2.3	2.3			PREDICT
Bangladesh				0.2					2-digit ISIC
Belarus		2.0	2.0	2.0	2.0	2.1	1.9		National definition
Belgium	2.1	2.1	2.1	2.1	2.1	2.1			PREDICT
Brazil	1.1	1.2	1.2	1.2	1.3	1.3			PREDICT
Bulgaria	1.8	1.9	2.0	2.0	2.1	2.2			PREDICT
Canada	2.6	2.6	2.6	2.6	2.6	2.7			PREDICT
China	1.7	1.8	1.8	1.9	1.9	2.0			PREDICT
Colombia						1.9	1.7	1.6	2-digit ISIC
Cyprus	1.6	1.6	1.7	1.8	2.0	2.1			PREDICT
Czechia	2.8	2.7	2.7	2.7	2.8	2.8			PREDICT
Denmark	2.7	2.6	2.6	2.6	2.6	2.6			PREDICT
Estonia	2.7	3.4	2.9	3.2	3.7	4.1			PREDICT
Finland	3.8	3.7	3.7	3.7	3.6	3.7			PREDICT
France	2.6	2.6	2.6	2.7	2.6	2.6			PREDICT
Germany	2.3	2.3	2.3	2.3	2.4	2.4			PREDICT
Ghana					0.7				2-digit ISIC
Greece	1.3	1.3	1.4	1.5	1.4	1.2			PREDICT
Hong Kong (China)							2.0		2-digit ISIC
Hungary	1.7	1.8	1.6	1.8	2.0	2.0			PREDICT
India	1.0	1.1	1.1	1.2	1.2	1.3			PREDICT
Ireland	4.7	3.7	3.8	3.6	3.6	3.7			PREDICT
Israel		5.2	4.8	4.5	4.6	4.6	4.7		2-digit ISIC
Italy	2.3	2.3	2.3	2.3	2.3	2.3			PREDICT
Japan	3.4	3.4	3.2	3.1	3.2	3.3			PREDICT
Rep. of Korea	4.5	4.4	4.3	4.1	4.3	4.4			PREDICT
Latvia	2.0	2.1	2.2	2.4	2.7	2.6			PREDICT
Lithuania	1.5	1.8	1.8	1.6	1.5	1.8			PREDICT
Luxembourg	3.2	3.3	3.4	3.4	3.5	3.5			PREDICT
Malaysia	5.6	5.6	5.3	5.0	5.0	4.9	4.9	4.9	2-digit ISIC
Malta	3.5	3.8	3.8	3.8	4.0	4.1			PREDICT

Economy	2010	2011	2012	2013	2014	2015	2016	2017	Notes
Mauritius				6.0	6.3	6.8	6.9		National definition
Rep. of Moldova				2.5	2.5	2.6	2.7	2.7	2-digit ISIC
Netherlands	2.4	2.4	2.4	2.4	2.5	2.5			PREDICT
Norway	2.5	2.5	2.5	2.5	2.6	2.5			PREDICT
Philippines						1.0			2-digit ISIC
Poland	2.0	2.0	2.1	2.2	2.3	2.3			PREDICT
Portugal	1.3	1.3	1.5	1.5	1.6	1.7			PREDICT
Qatar			0.4			0.3			2-digit ISIC
Romania	1.4	1.5	1.9	1.9	2.0	2.3			PREDICT
Russian Federation	1.4	1.3	1.3	1.3	1.2	1.3			PREDICT
Serbia	1.8	1.9	2.0	2.1	2.1	2.3	2.3	2.5	2-digit ISIC
Slovakia	2.6	2.7	2.7	2.8	2.8	2.8			PREDICT
Slovenia	2.4	2.4	2.4	2.5	2.6	2.7			PREDICT
Spain	1.9	2.0	2.0	2.1	2.1	2.2			PREDICT
Sri Lanka				0.4					2-digit ISIC
Sweden	3.5	3.4	3.5	3.5	3.5	3.4			PREDICT
Switzerland	2.9	3.0	3.0	3.1	3.1	3.0			PREDICT
Taiwan Province of China	8.8	9.2	9.2	9.0	8.9	9.0			PREDICT
United Kingdom	3.0	3.2	3.1	3.2	3.3	3.4			PREDICT
United States	2.6	2.6	2.7	2.7	2.7	2.7			PREDICT
Uruguay					1.2				2-digit ISIC
MEDIAN	2.4	2.4	2.4	2.4	2.6	2.5	2.5	2.6	

Statistical sources

International

European Commission Science Hub, Prospective insights on R&D in ICT (PREDICT). Data and metadata. Available at: https://ec.europa.eu/jrc/en/predict/ict-sector-analysis-2018/data-metadata, for Harmonized ICT Sector value added and employment data for 40 economies.

Eurostat, Detailed breakdowns of main GDP aggregates (by industry and consumption purpose) (nama_10_dbr). European Commission, Luxembourg. Available at: https://ec.europa.eu/eurostat/data/database, for 2-digit ISIC ICT Sector value added and employment data for European Union members and some non-members.

OECD, National accounts at a glance. Paris. Available at: https://stats.oecd.org/Index.aspx?DataSetCode=NAAG, for 2-digit ISIC ICT sector value added data for some OECD members and some non-members.

United Nations, National Accounts Official Country Data, at: http://data.un.org/Explorer.aspx?d=SNA, for Section J. Information and Communication (ISIC 4.0) and Division 64 Communications (Post and Telecommunications) (ISIC 3.1).

National

The State Statistical Committee of the Republic of Azerbaijan (2017). Information society in Azerbaijan. Available at: https://www.stat.gov.az/source/information_society/?lang=en.

Bangladesh Bureau of Statistics (2015). Economic census 2013. Dhaka.

National Statistical Committee of the Republic of Belarus (2017). Information society in the Republic of Belarus. Minsk. Available at: http://www.belstat.gov.by/en/ofitsialnaya-statistika/real-sector-of-the-economy/communication-and-ict/information-and-communication-technologies/publications/index_7866/".

Índice País Digital, Chile. Desarrollo digital en Chile. Available at: http://www.indicepaisdigital.cl/.

Departamento Administrativo Nacional de Estadística, Colombia (2018). Cuenta satélite de las tecnologías de la información y las comunicaciones (TIC). Available at: https://www.dane.gov.co/index.php/en/estadisticas-por-tema/cuentas-nacionales/cuentas-satelite/cuenta-satelite-de-las-tecnologias-de-la-informacion-y-las-comunicaciones-tic.

National Communications Authority, Ghana (2017). Determining the contribution of ICT/telecommunications sector to gross domestic product (GDP) in Ghana. Available at: https://www.nca.org.gh/media-and-news/news/invitation-for-comments-on-the-contribution-of-icttelecommunications-sector-to-gross-domestic-product-gdp-in-ghana/.

Census and Statistics Department, Hong Kong (China) (2017). Key statistics on business performance and operating characteristics of the information and communications, financing and insurance, professional and business services sectors. Available at: https://www.censtatd.gov.hk/hkstat/sub/sp350.jsp?productCode=B1080013.

Bank of Israel (2018). Annual report 2017: Statistical appendix and complementary data. Available at: https://www.boi.org.il/en/NewsAndPublications/RegularPublications/Pages/DochAppPartB2017.aspx.

Department of Statistics, Malaysia (2017). Information and communication technology satellite account 2016. Available at: https://www.dosm.gov.my/v1/index.php?r=column/cthemeByCat&cat=319&bul_id=MjhtcEV6dGFSOGc3NnEwaytRUkhTUT09&menu_id=TE5CRUZCblh4ZTZMODZIbmk2aWRRQT09.

Statistics Mauritius (2018). ICT statistics year 2017. Available at: http://statsmauritius.govmu.org/English/Publications/Pages/ICT_Stats_Yr17.aspx.

Ministry of Business, Innovation and Employment, New Zealand (2017). Information and communications technology: Success breeds success. New Zealand Sectors Report Series. Auckland.

Philippine Statistics Authority (various years). Annual survey of Philippine business and industry (ASPBI) – Information and communication sector for all establishments: Final results. Available at: https://psa.gov.ph/statistics/survey/business-and-industry/aspbi.

Philippine Statistics Authority (various years). Annual survey of Philippine business and industry (ASPBI) - Manufacturing: Final results. Available at: https://psa.gov.ph/statistics/survey/business-and-industry/aspbi.

Qatar Planning and Statistics Authority (various years). Annual bulletin of transport and communications statistics. Available at: https://www.mdps.gov.qa/en/statistics1/pages/topicslisting.aspx?parent=Economic&child=TransportCommunications.

Qatar Planning and Statistics Authority (various years). The annual bulletin of industry and energy statistics. Available at: https://www.mdps.gov.qa/en/statistics1/pages/topicslisting.aspx?parent=Economic&child=EnergyandIndustry.

Statistics Singapore (2017). Services survey series 2016: Information and communications services. Available at: https://www.singstat.gov.sg/publications/industry/sss-it-services.

Statistics Singapore. Manufacturing - Latest data. Available at: https://www.singstat.gov.sg/find-data/search-by-theme/industry/manufacturing/latest-data.

Statistics South Africa (2017). Information and communication technology satellite account for South Africa, 2013 and 2014. Available at: http://www.statssa.gov.za/?page_id=1854&PPN=Report-04-07-01.

Department of Census and Statistics Sri Lanka, National Accounts Division (various years). Annual survey of industry. Available at: http://www.statistics.gov.lk/page.asp?page=Industry.

National Economic and Social Development Board, Thailand. National income of Thailand 2016: Chain volume measures. Available at: https://www.nesdb.go.th/nesdb_en/ewt_news.php?nid=4351&filename=national_account.

Instituto Nacional de Estadística, Uruguay (various years). Encuesta de actividad económica. Available at: http://www.ine.gub.uy/web/guest/industria-comercio-y-servicios.

Notes

37 Haskel and Westlake (2018) highlight the problems of measurement of intangible assets. Four main characteristics differentiate them from tangible assets: they are more likely to be scalable, to have sunk costs, to generate spillovers and to develop synergies with each other.

38 See, for instance, Nakamura et al., 2017; and Brynjolfsson et al., 2019.

39 For more detailed discussions on the challenges to measuring the digital economy, see IMF, 2018; Barrera et al., 2018; Ahmad and Ribarsky, 2018; Sturgeon, 2018; and OECD, 2014 and 2019c.

40 See: https://www.itu.int/en/ITU-D/Statistics/Pages/intlcoop/partnership/default.aspx.

41 See: https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx.

42 See the UNCTAD website on *Measuring E-commerce and the Digital Economy* at: https://unctad.org/en/Pages/DTL/STI_and_ICTs/ICT4D-Measurement.aspx; and the UNCTAD Statistics portal, UNCTADStat, at: https://unctadstat.unctad.org/EN/.

43 See: http://www.oecd.org/going-digital/.

44 For further details, see G20 DETF, 2018.

45 See: https://ec.europa.eu/digital-single-market/en/digital-scoreboard and https://ec.europa.eu/digital-single-market/en/news/new-monitoring-framework-digital-economy-and-society.

46 See also: https://www.caf.com/app_tic/#en.

47 Under the International Standard Industrial Classification (ISIC) Revision 4, an alternative aggregation includes manufacturing, trade, software publishing and repair of equipment as well as the ICT services industries that are included in the InfoComm sector (Section J), which consists of publishing, film, sound, broadcasting and ICT services industries (i.e. telecommunications (61), computer programming, consultancy and related activities (62) and information services activities (63)) (see United Nations, 2008).

48 UNCTAD draws on available data on value added in the ICT sector from the United Nations, Eurostat, the OECD, the European Commission's *Prospective Insights in ICT R&D (PREDICT),* and national sources. In total, data on value added in the ICT sector cover 68 economies, including 31 developing and transition economies (see annex to this chapter).

49 See *Forbes,* 15 May 2019, The largest technology companies in 2019: Apple reigns as smartphones slip and cloud services thrive.

50 See NASSCOM, 2018; and Digital India at: http://www.digitalindia.gov.in.

51 See ILO, ISCO-08 Structure, index correspondence with ISCO-88, at: http://www.ilo.org/public/english/bureau/stat/isco/isco08/.

52 ICT service managers; ICT professionals (software and multimedia developers and analysts, and database specialists and systems administrators); information and communications technicians (ICT operations and user support technicians, and communications technicians); electronic engineers; telecommunication engineers; graphic and multimedia designers; information technology trainers; ICT sales professionals; electronics engineering technicians; electronics mechanics and servicers; ICT installers and servicers (see: https://ec.europa.eu/eurostat/statistics-explained/index.php/ICT_specialists_in_employment#Number_of_ICT_specialists).

53 *Dhaka Tribune* (citing the Government's ICT Division) 20 September 2017, Freelancers turn Bangladesh into a hub for ICT outsourcing.

54 The list of ICT goods was defined by the OECD using the 2007 version of the Harmonized System (HS). This definition was revised in 2010 and then adapted to HS 2012 and HS 2017 by UNCTAD in collaboration with the United Nations Statistical Division. The most recent list consists of 94 goods defined at the 6-digit level of HS 2017. For more information, see UNCTAD, 2018c.

55 See *Business Korea*, 13 February 2019, S. Korea's IoT sales reach 8.6 tril. won in 2018.

56 See also *The Economist*, 12 April 2018, Why Samsung of South Korea is the biggest firm in Vietnam, at: https://www.economist.com/asia/2018/04/12/why-samsung-of-south-korea-is-the-biggest-firm-in-vietnam.

57 This section uses the definition of ICT services developed by the UNCTAD Task Group on International Trade in Services and presented to the United Nations Statistical Commission at its 47th session (UNSC, 2016).

58 For example, not all "business services" (Extended Balance of Payments Services Classification, EBOPS 2010, main item 10) can be delivered over ICT networks, even though ICT solutions can be used to facilitate their delivery (e.g. water, gas and electricity distribution or waste treatment and depollution).

59 They include professional and management consulting, technical and trade-related services, as well as R&D.

60 The BEA is considering modifying its questionnaire to be able to capture actual ICT-enabled services (Nicholson, 2018).

61 One report (Google and Temasek, 2016) found that travel accounted for 71 per cent of B2C e-commerce in South-East Asia in 2015.

62 Data from Instituto Nacional de Estadística, Geografía e Informática (INEGI) (https://www.inegi.org.mx/temas/vabcoel/).

63 See ictDATA.org blog on data centres for Africa, at: https://www.ictdata.org/2018/04/africa-reliable-electricity-and-digital.html.

64 Rather insignificantly for most developing economies or which might merit inclusion as they largely refer to goods which are increasingly digitized, such as medical equipment, watches and photographic equipment.

This chapter looks at systemic dynamics of digitalization at the global level, and the ways they affect value creation and capture. It begins by highlighting the growing reach of a few global digital platforms and how this is linked to the ability to transform data into value. It then explores the reasons for the high degree of market concentration among these global digital players in the data-driven economy. Section C discusses issues related to the international dimension of data and data flows. Section D explores some implications of the data-driven economy in connection with global value chains. This is followed by a discussion of other issues related to value creation and capture, such as taxation of global digital platforms and the implications for employment and platform work. The final section draws the main conclusions from the analysis.

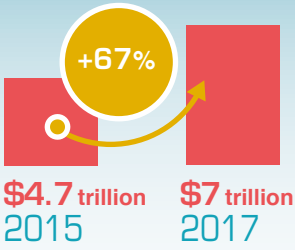
VALUE CREATION AND CAPTURE IN THE **DIGITAL ECONOMY**: A **GLOBAL** PERSPECTIVE

4

VALUE CREATION AND CAPTURE IN THE DIGITAL ECONOMY: A GLOBAL PERSPECTIVE

Global digital platforms have achieved very strong market positions

Combined value of the platform companies with a market capitalization of > $100 million



Factors explaining the rapid rise to dominance

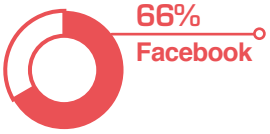
- network effects
- ability to extract, control & analyze data
- high switching costs

US and China giants share in the global digital services market

Internet search market


World's online retail activity


Global cloud infrastructure services

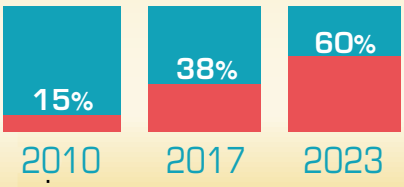

Global social media market


Mobile payment solution


Active users

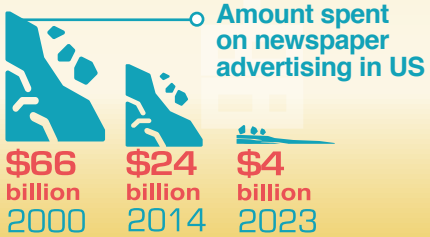

The growing power of digital platforms has global implications that are likely to accentuate inequalities

Internet advertising share in the **global advertising revenue**

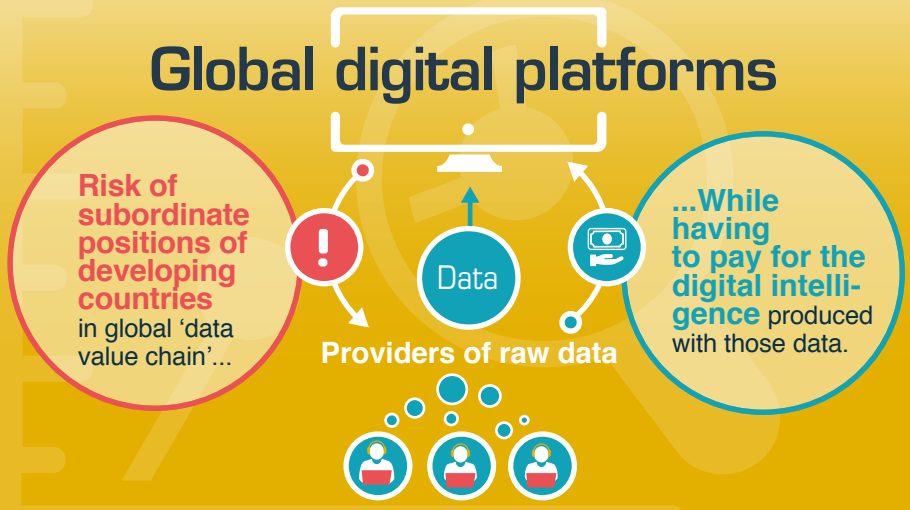


Digital advertising spending more and more concentrated

Erosion of advertising as a viable revenue source for other businesses



Global digital platforms



The dominance of global digital platforms and their capacity to create and capture the ensuing value, are set to accentuate global inequalities. Breaking this vicious circle to generate a fairer distribution of gains from data and digital intelligence requires out of the box thinking.

A. GLOBAL REACH OF MAJOR DIGITAL PLATFORMS

As discussed in previous chapters, a major feature of the evolving digital economy is the rise of a few, very large global digital platforms, mainly from the United States but also from China. Seven of the world's top eight companies by market capitalization have data-centric business models (PwC, 2018a). Yet only a decade ago, the world's largest companies by market capitalization were industrial giants in oil and manufacturing, such as Exxon Mobil and GE. While the highest ranked enterprises today may have begun as software companies (Apple and Microsoft), or as Internet companies (Alibaba, Amazon, Facebook, Google and Tencent), they now focus heavily on data and digital intelligence.

The platform-based economy is growing fast. A study of the leading digital platform companies has estimated their combined market value at $7,176 billion in 2017 (Dutch Transformation Forum, 2018) – 67 per cent higher than an estimate of $4,304 billion in 2015 (Evans and Gawer, 2016).[65] Seven "super platforms" – Microsoft, followed by Apple, Amazon, Google, Facebook, Tencent and Alibaba – accounted for two thirds of the total value in 2017, each having a market value of more than $250 billion. And in 2018 and 2019, Apple, Amazon and Microsoft each exceeded a $1 trillion market valuation.[66]

This also points to a high geographical concentration of the platform economy, as noted in chapter I. The United States accounts for 72 per cent of the total market capitalization of platforms valued at more than $1 billion, followed by Asia (mainly China), with 25 per cent, whereas the EU's share is only 2 per cent (Dutch Transformation Forum, 2018). There is less concentration in terms of the number of platforms: 46 per cent are based in the United States, 35 per cent in Asia (mainly China), 18 per cent in the EU and 1 per cent in Africa and Latin America.

Although the global digital platforms in the United States and China have some features in common, namely market dominance and control of data and digital intelligence, they have emerged in very different economic environments. In the United States, some government support was provided, mainly at the early stages of development of the Internet, through basic research. But the platforms there have grown in the context of a free market, resulting from the workings of private market forces in the digital economy. The emergence of China's top digital platforms, on the other hand, was supported by significant government interventions, including protection from competition by foreign platforms (Thun and Sturgeon, 2017; Bieliński, 2018).

As for profits, United States global platform companies earned the largest amounts. They accounted for 80 per cent of the profits of the world's 50 largest digital platforms, in 2015, compared with only 5 per cent earned by European ones.[67] Meanwhile, some data-related companies are commanding huge valuations without ever having made a profit. The large sums being invested in digital corporations running considerable losses are unprecedented. Examples include the ride-sharing companies Uber and Lyft, which had their initial public offerings (IPOs) in 2019 on the back of a history of losses.[68] In 2018, Walmart bought 77 per cent control of India's top e-commerce company, Flipkart – which is just 11 years old, and with few tangible or IP assets – valuing it at $22 billion. This was despite both Flipkart and Amazon having run up considerable losses in India.[69]

Both their high market valuations and the speed at which global digital companies have attained high capitalizations attest to the new value associated with being able to transform digital data into digital intelligence. Investors are betting on the disruption and reorganization of whole economic sectors, such as retail, transport and accommodation, or health, education and agriculture, by investing in long-term, digital-intelligence-based control of those sectors, which, they believe, will enable the generation of high profits in the future. Such disruption may involve sweeping away traditional players as well as preempting the emergence of new digital competitors. By introducing new products, services and business models, global digital companies become factors of disruption in sectors as varied as transport, accommodation, banking, education and the media.

Corporate leaders in traditional sectors are also beginning to realize the crucial value of data for their businesses. For example, Monsanto (now acquired by Bayer), GE and Intel, giants in agriculture, industry and ICT hardware, respectively, are increasingly redefining themselves as data-centric companies.[70]

Some digital platforms can shoulder losses, not only because they have the backing of investors (Kenney and Zysman, 2019), but also because they operate in multi-sided markets. This enables them to sometimes offset losses in one segment of the market by profits

generated in another segment. For example, Google is well known for its dominance in the search market, where it holds about a 90 per cent market share, and Facebook is the dominant social media platform, accounting for 66 per cent of the global market share.[71] However, most of the revenues of these two companies come from the digital advertising market, in which they have become dominant too (see section IV.D.2 below). In the case of Amazon, which is best known for its online retail service, where it has a global market share of 37 per cent, the main source of revenue is its cloud computing business conducted by Amazon Web Services.[72] In the Chinese market, WeChat (owned by Tencent) has more than 1 billion active users and, together with Alipay (Alibaba's payment platform), accounts for virtually the entire Chinese market for mobile payments.[73] Meanwhile, Alibaba is estimated to have captured close to 60 per cent of the Chinese e-commerce market (Internet Society, 2019).

Many global platforms may prioritize growth over profits because of the importance of getting control of data to secure a strong market position. Since technological developments which are expected to have an impact in the future, such as AI and machine learning, are increasingly based on the control of massive amounts of data and digital intelligence, dominant control over data allows companies to be well-positioned to capture the gains from future technological developments too.

B. MARKET CONCENTRATION DYNAMICS

The market dominance of certain global digital platforms is a result of a number of factors which, together, help explain the growing power of these companies. This section examines, in particular, monopolistic trends linked to the nature of data-driven business models and markets, actions taken by platforms to reinforce their market positions, the expansion of digital platforms into new sectors, asymmetric information, and lobbying activities to influence policymaking.

1. Monopolistic trends

A key characteristic of the most successful digital platforms is their rapid capture of considerable market shares. Three main factors help explain why platforms tend to become monopolies.

The first and most significant factor is *network effects* (see also chapter II): the more users of a platform, the more valuable that platform becomes for everyone. Taking the example of Facebook, the more friends, family and colleagues that are on the platform, the more useful it becomes as a tool for social engagement and connection. With Uber, network effects hold across the different sides of the platform: more drivers mean riders are more likely to find a ride, which in turn leads to more riders using the platform. As more riders appear, drivers see less downtime and more income, leading more drivers to join the platform. As a result, a virtuous cycle is built between the two sides of the platform. Crucially, with network effects, a threshold is reached at some point, whereby it makes more sense for a new user to simply join the biggest existing platform. With such a "winner-takes-all" dynamics, existing and potential competitors easily fall by the wayside. This operates at a global level as well. In the Republic of Korea, for example, a national social networking platform called Cyworld was eventually unable to cope with competition from a global social media network (box IV.1).

The second factor is the platforms' *ability to extract, control and analyse data*. Since they are positioned as intermediaries, they accumulate data from every interaction. This typically gives platform owners a major competitive advantage over non-platform companies. Effectively, the more data that can be accessed and transformed into digital knowledge, the more the company can cut costs, satisfy customers and improve its products relative to more data-light competitors. As with network effects, a virtuous cycle can emerge: fewer rivals mean more users, more users mean more data, and more data mean rivals can be outcompeted.

The third contributory factor is the dynamics of *path dependency*. Once a platform begins to gain traction, the costs to users of switching to an alternative platform start to increase (Klemperer, 1987; Farrell and Klemperer 2007). Users of social media, for instance, invest time and data into building their profiles and personalizing services. Leaving a platform may mean leaving behind years of messages, posts and photos, which discourages users from switching to another platform. Likewise, ecosystems of developers learn the code and nuances of a particular innovation platform to build tailored apps and features for them. Moving to a new platform may require re-learning this material. Businesses also tend to orient their operations around working on and with particular platforms.

Box IV.1. Cyworld versus Facebook

Launched as a social networking platform in 2001, Cyworld rapidly gained success in the Republic of Korea, although it failed in its various efforts to expand internationally (Arrington, 2009). By 2003, the term "cyholic" had become a popular way to describe users' addiction to the site and (even before Facebook existed) over a quarter of the country had signed up (Ghedin, 2013; Evans, 2005). The company at times liked to boast about the visit of Mark Zuckerberg (the founder of Facebook) to their offices to learn about social media (Tong-hyung, 2011). At its peak, half the population in the Republic of Korea was on its website in some form (Ghedin, 2013). However, by 2011, user numbers were in decline, and most had shifted to Facebook (Ja-young, 2011).

Global network effects were partly responsible for this development. Once Facebook, Twitter and other global platforms came along, users in the Republic of Korea preferred to be connected to these much broader networks than to this once predominant platform. Developers sought more global markets and users sought more global connections (Ghedin, 2013). The end result was that a major national platform with a long-established footprint went into terminal decline.

Source: UNCTAD.

A controversial example was when video was lauded as the future of the Facebook newsfeed, and media companies subsequently pivoted to video in order to take advantage of this shift. The result was major layoffs of traditional journalists, and complete reorganizations of these businesses, making them increasingly dependent on Facebook for visibility.[74] This dependence made them subject to the fluxes in Facebook's algorithm.[75] Apple demonstrates a path dependence logic in its attempt to lock in users via proprietary hardware and software: buying into an Apple product entails buying into all the Apple attachments required for it. Once users have invested in building up this stock of products, they become less likely to change to a competitor.

In the absence of radical technological changes capable of entirely disrupting their business models, the success of these platform companies has been built on the virtuous cycles of network effects. Indeed, the reason why every competitor to Facebook has failed (and why a vastly larger number of entrepreneurs have never tried to compete) is that network effects are immensely difficult to challenge. In addition, platform companies have built increasingly large moats around their businesses. Crucially, these moats are not just about data; hardware and skilled workers also help them consolidate their market positions and strategic advantages (Mayer-Schonberger and Ramge, 2018; Howard, 2018; Nahles, 2018). The reason why opening its data to other companies would be unlikely to threaten Google's dominance as a search engine is because vast amounts of computing power and talent are required to turn raw data into digital intelligence and business opportunities. The natural monopoly power of the largest platforms will therefore not be easily tackled by minimal, national pro-competition policies (chapter VI).

2. How platform companies strengthen their market positions

Global digital platform companies have taken various measures to consolidate their market position. Given the importance of data and network effects, they are driven by competitive market pressures to expand their data extraction infrastructure, extract data ever more intensively, and enclose users within their platform.

An important strategy has been the acquisition of existing or potential competitors. For example, Facebook bought Instagram as a rising social media competitor in 2012, and WhatsApp as a competitor to Messenger in 2014. Facebook is also reported to have developed an early warning system to alert it to rising competitors.[76] Google has similarly bought up competitors, most notably Waze, which presented a rising challenge to Google Maps. Google has made more than 230 acquisitions throughout its history, at a rate of one per week at some points in time.[77] Today, many new start-ups often aim to eventually be bought by Facebook, Google or Amazon, rather than compete against them.

Table IV.1 presents details of a selection of significant acquisitions in recent years by the six major technology companies: Alibaba, Alphabet, Amazon, Apple, Facebook, and Microsoft. Since available data do not always reveal the dollar value of acquisitions, the

Table IV.1. Selected acquisitions by six major digital platforms, 2010–2018

Year	Target company	Industry	Target economy	Acquirer (Ultimate parent)	Deal value ($ million)
2010	111 Eighth Avenue	Non-residential real estate	United States	Alphabet Inc	1 900
2011	Skype Global Sarl	Software	Luxembourg	Microsoft Corp	8 505
2012	Motorola Mobility Holdings Inc	Telecom equipment	United States	Alphabet Inc	12 450
2012	Yammer Inc	Software	United States	Microsoft Corp	1 200
2012	Instagram Inc	Internet software and services	United States	Facebook Inc	1 000
2014	WhatsApp Inc	Internet software and services	United States	Facebook Inc	19 468
2014	Nokia Oyj-Devices & Services Business	Telecom equipment	Finland	Microsoft Corp	4 991
2014	Nest Labs Inc	Electronics	United States	Alphabet Inc	3 200
2014	Beats Electronics LLC	Electronics	United States	Apple Inc	3 000
2014	Mojang AB	Software	Sweden	Microsoft Corp	2 500
2014	Oculus VR Inc	Software	United States	Facebook Inc	2 181
2014	AutoNavi Holdings Ltd	IT consulting and services	China	Alibaba Group Holding Ltd	1 081
2016	LinkedIn Corp	E-commerce/B2B	United States	Microsoft Corp	26 639
2016	Suning Commerce Group Co Ltd	Computers and electronics retailing	China	Alibaba Group Holding Ltd	4 547
2016	Youku Tudou Inc	E-commerce/B2B	China	Alibaba Group Holding Ltd	4 392
2016	Lazada South East Asia Pte Ltd	Internet and catalogue retailing	Singapore	Alibaba Group Holding Ltd	1 000
2017	Whole Foods Market Inc	Food and beverage retailing	United States	Amazon.Com Inc	13 561
2017	PT Tokopedia	Internet and catalogue retailing	Indonesia	Alibaba Group Holding Ltd	1 096
2017	Lyft Inc	Software	United States	Alphabet Inc	1 000
2017	Souq.com	Internet and catalogue retailing	United Arab Emirates	Amazon.Com Inc	580
2018	GitHub Inc	Computers and peripherals	United States	Microsoft Corp	7 500
2018	Jamestown LP-Chelsea Market, New York	Non-residential real estate	United States	Alphabet Inc	2 400
2018	Sun Art Retail Group Ltd	Food and beverage retailing	Hong Kong (China)	Alibaba Group Holding Ltd	2 065
2018	Focus Media Information Technology Co Ltd	Advertising and marketing	China	Alibaba Group Holding Ltd	1 146

Source: UNCTAD cross-border M&A database.

table lists acquisitions with a value stated to exceed $1 billion, except for the takeover of Souq by Amazon, which was valued at less.[78] Of these large acquisitions, the majority have involved targets in the home country of the ultimate acquirer (e.g. China in the case of Alibaba, and the United States for the others), and companies in high-technology industries. Major acquisitions of high-technology companies included Microsoft's acquisition of LinkedIn ($27 billion) and Facebook's acquisition of WhatsApp ($19 billion). Alphabet and Microsoft also made acquisitions in the telecommunications equipment industry: Motorola ($12 billion) and Nokia ($5 billion), respectively. Alibaba and Amazon made important acquisitions in the retail industry, including Amazon's takeover of Whole Foods Market ($14 billion). In addition, Alibaba made a large acquisition in the advertising and marketing industry, and Alphabet made major acquisitions in non-residential real estate.

In cases where target companies have refused offers to be acquired, another strategic response by global digital platforms has been to copy the competitor. For example, in 2013, Facebook reportedly approached Snapchat – a competing social media platform – with an offer to acquire it for $3 billion. The offer was declined, and Snapchat later proceeded with an IPO in 2017 valued at around $33 billion. After the rejection, Facebook introduced many of the features that had made Snapchat unique, by adding augmented reality effects, QR codes, the "story" format, similar filters, and even similar interfaces. Snapchat has since been plagued by low user growth and dwindling investor confidence, with shares down about 75 per cent from its opening day price (Gallagher, 2018).[79] In this case, even a $33 billion company was unable to compete with the resources of a top-tier platform.

The largest platform companies also consolidate their market positions by large amounts of capital expenditure and R&D spending – a strategy familiar to other industries in pharmaceuticals and energy, for instance. Amazon and Google, for example, have emerged as the top two global spenders on R&D (PwC, 2018b). Companies that spend large amounts on proprietary information technology can also benefit from major productivity increases, thereby giving them significant competitive advantages (Bessen, 2017). For instance, the global cloud infrastructures of Alibaba, Amazon, Google and Microsoft require immense investments that are unavailable to the vast majority of potential competitors. Even just limiting the focus to tangible assets, the major United States and Chinese technology companies have spent billions on property and equipment. The resources which the top platform companies invest in AI are similarly vast. In 2017, companies spent around $21.3 billion through AI-related mergers and investments – 26 times more than in 2015.[80] All of the largest platforms have major infrastructural footprints which represent another high barrier to entry for competitors.

3. Expansion into other sectors

With their insatiable appetite for data, many global platforms are starting to "eat the world".[81] Platforms have sought to leverage their intermediary role in order to take over their own verticals (i.e. the different sides of the platform). For Chinese platforms, this has been a relatively common approach: loose intellectual property rights have meant that companies cannot rely on a single good idea; instead, they have to build protection from competition via vertical integration (Lee, 2018a). There are similar examples relating to United States platforms, as follows:

- Facebook is spending up to $1 billion on original content in the form of TV shows.[82]
- Google is producing its own services, such as review sites, rather than relying on external providers.[83]
- Amazon has moved into supplying its own branded products (AmazonBasics). Its position as a platform for buyers and sellers gives the company information about which products are selling at what prices and to what customers. Some merchants have accused Amazon of using these data to copy their products and introduce cheaper (and more highly visible) versions on its website (Khan, 2017).[84] As a result of this practice, the European Commission has begun preliminary investigations into whether these data are used to undercut competitors.[85]

Uber was once described as being the largest taxi company in the world, even though it owned no vehicles (Goodwin, 2015). It is now placing bets on a future of driverless cars. In 2015, it bought most of Carnegie Mellon's robotics researchers, and in 2017 it announced it would be buying up to 24,000 vehicles from Volvo as part of its driverless car programme.[86] In effect, this can be seen as a move by Uber to expand its ownership of cars on the taxi side of its platform, thereby becoming a competitor to existing tax drivers using the Uber platform.

Beyond verticals, platforms are spreading their activities into non-digital industries as they become increasingly digitized. Examples of this include Google's and Tencent's ventures into self-driving cars, Amazon's efforts at producing tablets and smartphones, Facebook's acquisition of virtual reality company Oculus, and Alibaba's spread into convenience stores. These expansions are driven less by traditional horizontal or vertical merger logic, than by following the data trails. The rise of AI is reinforcing this trend, as machine learning is a general-purpose technology that can be used across a variety of industries (Bresnahan and Trajtenberg, 1995; Jovanovic and Rousseau, 2005). Thus, companies that specialize in AI can move relatively easily into new industries and deploy their services there as well. For instance, companies specializing in AI are moving into industries such as energy, health care and transportation, which are much larger than the advertising industry.

Unsurprisingly, strategic partnerships between MNEs in traditional sectors and global digital platform corporations are increasingly being explored. The aim is to leverage key advanced technology platforms (e.g. AI and IoT) and horizontal digital competencies (e.g. voice AI and motion control expertise) across sectors. Lead digital firms are partnering with companies offering complementary competencies. For example, recognizing the advantage Amazon's voice assistant, Alexa, can provide to its e-commerce operations, Walmart has partnered with Google to use Google Assistant.[87] Ford and Daimler have joined Baidu in its Apollo platform, dubbed by some as the android of "autonomous driving" (CBInsights, 2018). Google has built the "Android Automotive" platform, with Volvo and Audi signing on. And GE, after going it alone with its Predix digital manufacturing platform, has partnered with Microsoft to use its Azure cloud services. Meanwhile, Intel and Facebook are working together to produce a new AI chip.[88]

With such strategic partnerships of digital business networks thus getting cemented around privately developed technical standards that seek sectoral dominance, the dynamics of monopolization risk being accelerated through the use of AI. Since contemporary machine learning relies upon massive datasets, vast computing resources and world-leading talent, a handful of companies (notably including Alibaba, Amazon, Google and Tencent) will be in a particularly strong position to provide general AI services.

4. Information asymmetry and data

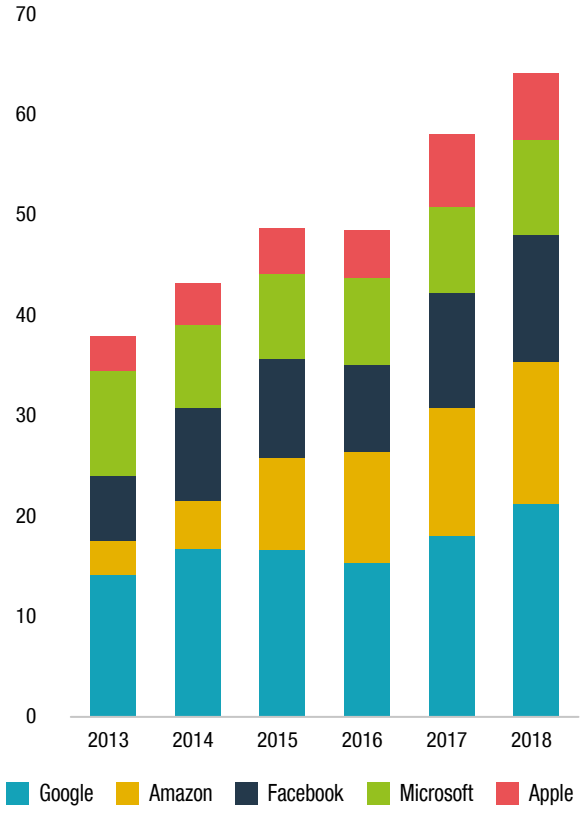
In the digital economy, platforms unilaterally control massive amounts of information about producers and consumers/users through deep digital penetration into the production systems of the former and personal virtual environments of the latter. Meanwhile, the two sides – producers and consumers/users – have no such information about each other, and they may not even have it about themselves, especially in terms of the width and level of detail contained in the information held by the platforms. Consequently, platform owners can influence the success of producers that use their marketplace by surfacing or "creating" consumer "demand" based on their analysis of deep behaviour/psychological patterns.[89] This can create significant information asymmetries between the platforms on the one hand, and the actors using the platforms on the other, thereby affecting the functioning of the market.

In this sense, the market's invisible hand becomes a digital one, increasingly managed by the platform companies.[90] Market regulation concepts, such as an open market, marked maximum retail price, competing firms, checks against price fixing and collusion, tend to lose meaning if prices are determined by private platforms in a dynamic and non-transparent manner, sometimes algorithmically. Rather than based on market signals in a decentralized economic organization, platforms may be able to centralize economic "planning" and execution across a sector or value chain by employing deep digital intelligence. Such digital economic (re)organization may be so highly efficient that the value generated can be shared with various economic actors in any sector in order to attract them onto the platform. As digital monopolies become entrenched, the terms of engagement may gradually shift towards the interests of the platform owners. Against this background, policies are needed to protect the interests of various economic actors engaged on digital platforms, preferably at early stages of platformization (chapter VI).

5. Engaging in global policymaking

Global digital platforms take their earlier imperatives of expand, extract and enclose beyond national boundaries. As such, they have an interest in lobbying for international rules and regulations that allow and enable them to leverage their business models. Indeed, in the past few years, technology

Figure IV.1. Annual spending on lobbying by digital platforms in the United States, 2013–2018
($ million)



Source: UNCTAD, based on Vox-Recode (2019).

companies have replaced the financial sector as the biggest lobbyists,[91] and major platforms have spent considerable resources in key locations. For example, in 2018 Google, Amazon and Facebook spent record amounts lobbying the Government of the United States (figure IV.1).

C. THE INTERNATIONAL DIMENSION OF DATA

Regarding the implications of the digital economy for international trade and development, a relevant and contentious issue is that of cross-border data flows (CBDFs). The global reach of global digital platforms, and the fact that they are driven by data, results in massive amounts of data flowing internationally between users and platforms located in different countries. Such flows of data across borders have become a prime concern for digital platforms and governments, though for different reasons.[92] As a result, the international policy debate about CBDFs is characterized by diverging views and conflicting interests (chapter VI). While it is clear that the nature of the digital economy requires a facilitation of data flows, it is important to consider the distributional aspects of CBDFs among countries.

As with the "ownership" of data (see chapter II), an analysis of the international dimension of data is complicated owing to the fact that data are a particular kind of resource, and one that still lacks a proper definition. In a conventional economic framework, the authorities are able to record international economic transactions. For example, exports and imports of goods are registered at customs offices and recorded in a country's balance of payments, as are international financial transactions. However, this is not always possible for CBDFs. Firstly, many data flows have no explicit value attached to them. Secondly, it is difficult to determine the geographical origins and destinations of the flows. And assigning territorial sovereignty, and therefore jurisdiction, is not obvious, as this may not be evident when digital data cross borders.

Since data generated by the citizens, businesses and organizations of a particular country are a major economic resource in the digital economy, which can be harnessed to create economic value, issues concerning "data sovereignty" arise. These are related to control, access and rights over the data at the international level, and the appropriation of the value that could be generated from refining them. Under the current regime, the platform that collects the data from the users is the one that controls and monetizes such data. As a result, global digital platforms have an advantage in terms of capturing data-related value.

One issue in this context is the lack of any global agreement for recognizing "ownership" of community data; once the data leave the home jurisdiction, the notion of ownership becomes largely meaningless. At present, data are primarily, and effectively, subject to the jurisdiction of the territory of residence of the parties that exercise control over their storage and processing, which for now is taking place overwhelmingly in developed countries where most data controllers reside. The only way for developing countries to exercise effective economic "ownership" of and control over the data generated in their territories may be to restrict cross-border flows of important personal and community data.

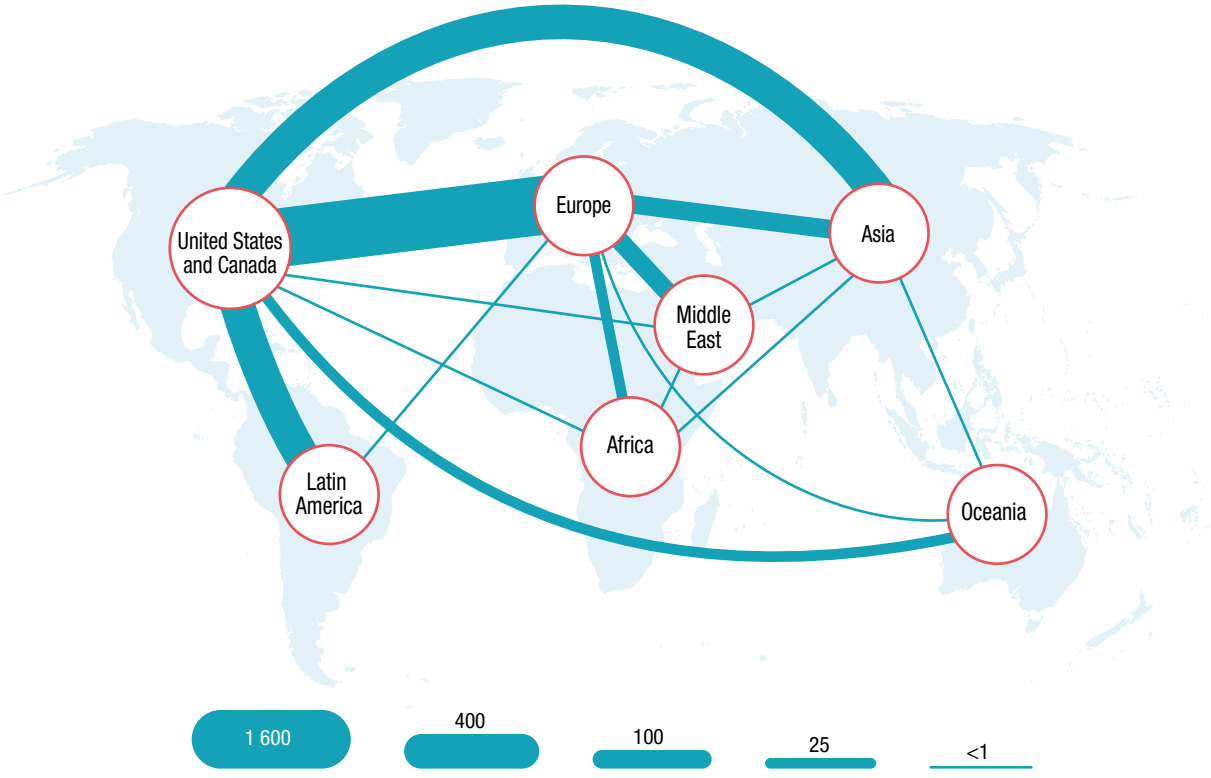
There is need for a clearer definition of CBDFs to inform policy discussions. International data transfers are often bundled together with e-commerce and digital trade (another concept in need of a better definition). However, while data flows can be closely linked to trade, and are quite important for trade in the digital economy, CBDFs in themselves may not involve either trade or e-commerce.

A related complication concerns the measurement of CBDFs (United States Department of Commerce, 2016). They can be approximated by data on international bandwidth, which are provided by a private company. Figure IV.2 shows interregional bandwidth capacity in 2018. Most capacity is found between North America and Asia, and between North America and Europe. Most Latin American interregional data flow capacity is with North America. Africa shows the lowest levels of data interconnection, with Europe being its main partner region.

A balanced analysis of the implications of CBDFs needs to take into account the divergent interests of various agents, individuals, firms and governments, as well as different countries. Since these interests do not always coincide, dilemmas and trade-offs emerge. Governments may decide to restrict the flow of data for reasons such as privacy of data and protection of their citizens, security, and the need to foster national economic development and market competition. The final outcome depends on policy choices. Different countries apply different regimes, ranging from allowing the free flow of data to data localization practices (chapter VI).

From the perspective of the global digital platforms, a smooth space for data flows enables them to minimize costs and avoid domestic regulations that might hinder them. The interests of different platform types are likely to vary in this context. For advertising platforms, such as Google and Facebook, more (local) data would mean opportunities for providing better, targeted advertising. Both these companies have been at the forefront of supporting enhanced Internet access to underserved populations through Facebook's Free

Figure IV.2. Use of interregional bandwidth, 2018
(Terabits per second)



Source: Telegeography (https://www.ptc.org/PTC19/Proceedings/WK_TELEGEO_Mauldin_Alan.pdf).

Basics and Google's Project Loon. However, their approaches are different. With Facebook's Free Basics, traffic is effectively channelled through a portal, reflecting the reliance of Facebook's business model on a more closed platform. Google, by contrast, is more dependent on the open web, and Project Loon has none of the restrictions that have caused controversy for Facebook. Amazon has announced plans to launch satellites to provide Internet access for underserved communities. Such access also serves the interests of the global digital platform by securing more users, more data, and therefore more value.

Cloud platforms also have a distinct interest in ensuring free, unimpeded flows of data as a way to minimize the costs of fixed infrastructure. Data localization laws would require cloud companies to build infrastructure within a country in order to access data from its citizens (Leviathan Security Group, 2015). However, recent years have seen an increasing concern with latency (the delay between a client's request and a cloud service provider's response) in cloud platforms. For many applications this may not be particularly relevant, but the growth of IoT – and particularly driverless cars – requires extremely fast delivery (Varda, 2018). This rise of "edge computing" may mean that cloud platforms are more interested in the geographical expansion of their digital footprint regardless of data localization laws. Many of them are currently building new data centres around the world, and often use low latency and geographical spread as selling points.

In order to facilitate the spread of digitalization and the uptake of the services offered by various digital platforms, there is a drive towards ensuring free data flows (Google, 2010; International Chamber of Commerce, 2016; Internet Association, 2017; Manyika et al., 2016; World Bank, 2016 and 2018b). It is argued that connectivity with the global digital economy is the path to development, and that restricting data flows will result in slower economic growth. Estimates of the negative impact range between a loss of 0.7–1.7 per cent of GDP for a number of developing countries, including Brazil, India and Indonesia (for China, some estimates suggest as much as 3.4 per cent), as domestic companies will have to pay 30–60 per cent more for cloud provision (Bauer et al., 2014; United States Chamber of Commerce, 2016; Leviathan Security Group, 2015).

Proponents of free data flows argue that barriers to accessing data hamper business innovation and economic growth. For instance, it has been argued that privacy rules impose new compliance requirements on firms and increase the costs of doing business, that data localization laws impose new costs on business by forcing them to invest in local infrastructure, and that any restrictions on data flows will result in less efficient and productive businesses (Cory, 2017; Manyika et al., 2016).

Nevertheless, many countries are hesitant to relinquish control over their data without getting anything in return. With data becoming an increasingly valuable resource in the digital economy, there are questions about the wisdom of allowing foreign firms to extract data without restraint. And with the global concentration of platforms, this "free flow of data" effectively means a "one-way flow" (Macbride Commission, 2003). Other reasons cited for considering the use of barriers to free flows of data include perceived risks to national security, surveillance by other countries, risks of hacking, and the need for easy access to data for law enforcement purposes (UNCTAD, 2013).

Cutting-edge digital technologies are not prevalent in developing countries. While countries need to continue to develop their technological capabilities, many developing countries believe that they should initially focus on leveraging the "local" resource of all-important data for digital value creation and capture. However, such data are of no use without the appropriate digital technologies and skills needed to transform them into digital intelligence and economic opportunities. To the extent that frameworks for local "ownership" and control of various kinds of important data can be developed, data could provide a significant bargaining chip to negotiate fair terms with global digital platforms seeking to work on local data and in domestic economies. Such frameworks could be employed to promote the development of digital industries, including through joint ventures with global corporations. This could be made a condition for mining local data. Building sufficiently strong domestic digital industries is required for a country to begin developing domestic digital technology capabilities.

Thus, while it is important that data be allowed to flow easily in order to harness the benefits of the digital economy, it is equally important to ensure that the associated gains are shared in a fair manner by the actors and countries involved in the value creation process. Moreover, impact assessments need to go beyond economic growth, and consider factors related to power relations, dependence, data privacy

and value capture. This may necessitate exploring new, alternative approaches that take into account all relevant aspects. In view of current trends, it is not evident that free flows of data and greater access to data alone will help address global inequalities. Governments, both from developed and developing countries, are increasingly recognizing that the collection and processing of people's data cannot be left entirely to private corporations. In the emerging global digital economy, it will be necessary to ensure that developing countries have the necessary economic, legal and regulatory space to shape their digital economies in ways that serve the interests of their populations, including by helping them to create and capture value from digital data (chapter VI).

D. DIGITAL DATA AND GLOBAL VALUE CHAINS

The international dimension of data also has implications for global value chains (GVCs). In particular, what is denoted as the "global data value chain" can be considered a new aspect to be taken into account when discussing GVCs and development. This section examines some specific value chains related to data, notably those associated with advertising and cloud computing. The discussion focuses on the position of developing countries in these chains.

1. Global data value chain

In the digital economy, it is useful to consider the way in which data are transformed from being mere information to having an economic value. A distinction can be made between the raw data produced by the data suppliers, the value-added data products produced by data companies, and the consumers of data products (Weber, 2017). For instance, users of Facebook are suppliers of raw data, Facebook as a company produces the value-added data products, which are then given back to the users for free (social interaction) and sold to companies seeking marketing opportunities (targeted advertising space).

From a geographical perspective, this emerging global "data value chain" sees the positioning of most countries as *data suppliers* while only a handful of platforms and countries that receive most of the data can turn them into value-added data products, which, in turn, can be monetized. Since "the value of that data depends on its ability to combine with other pieces of data, […] this positive network effect will create benefits at an increasing rate in places that are the landing points for broad swathes of data" (Weber, 2017: 406).

A number of developing countries have entered into deals whereby data from their economies are given away in return for technology and capacity-building. For example:

- Zimbabwe has signed a deal with the Guangzhou-based company, CloudWalk, whereby the Government will receive assistance with surveillance technology, and CloudWalk will receive data from facial recognition (Jie, 2018).
- In Rwanda, Babyl, owned by UK-based Babylon, has partnered with the Ministry of Health to provide the relevant technology and offer free online health-care services (e.g. consultations and booking appointments) to users in return for the extraction of those users' data (Crouch, 2018). Thus, medical data that flow to Babyl will essentially give the company a monopoly position.

In the future, multinational agriculture companies might collect raw data from farmers, then use them to develop a system of rules that optimize productivity and output, and subsequently sell the data back to those same farmers who provided the raw data. The search for data is also behind Baidu's decision to open up its self-driving car platform, and Alibaba's decision to offer cloud computing services to convenience stores for free.[93] In these cases, companies seek to gain access to technology or applications in return for sharing their data with the platform companies.

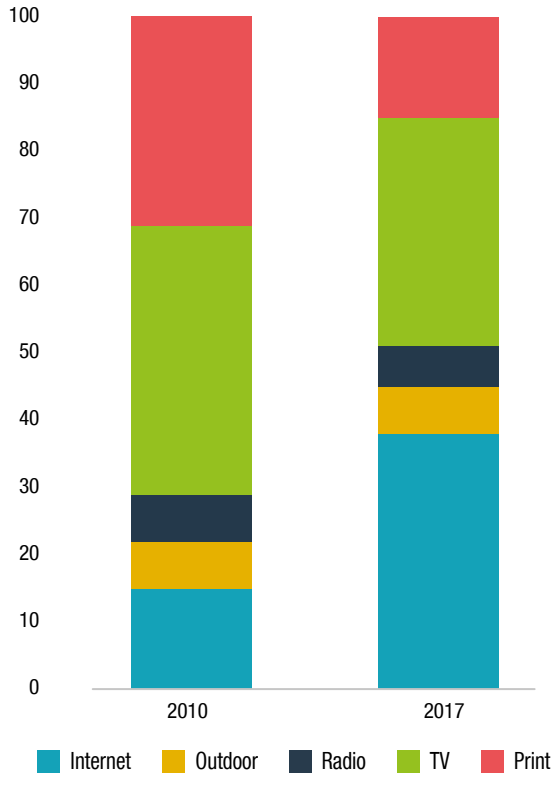
From the perspective of the global data economy, the work being done in developing economies is typically of low value. Companies like Samasource outsource the task of labelling data to countries in Africa and elsewhere (Lee, 2018b). Similarly, low-wage "data factories", generally involved in the highly repetitive work of simply applying labels to data (typically images), with painstaking precision, are popping up in remote areas of China.[94] Yet the repetitive nature of this work also makes it potentially subject to eventual automation (Autor, 2014). The consequence of these dynamics is that, instead of latecomer economies catching up in the data economy, their subordinate status may get accentuated. The risk is that most countries, and particularly the LDCs, will become exporters of raw data, and importers of value-added data products, with little domestic ability to potentially change this relationship.

2. Digital advertising revenue

In the evolving data-driven economy, the growth of digital platforms has implications for various specific value chains. With more and more social and economic activities moving online, digital advertising becomes increasingly important. Not only are some digital platforms depending on targeted advertising to generate revenue, analog media businesses such as newspapers, magazines and television are also being compelled to transition from their traditional means of securing advertising funding to online portals. As digital platforms expand their global reach, the distribution of advertising value is affected across both sectors and countries.

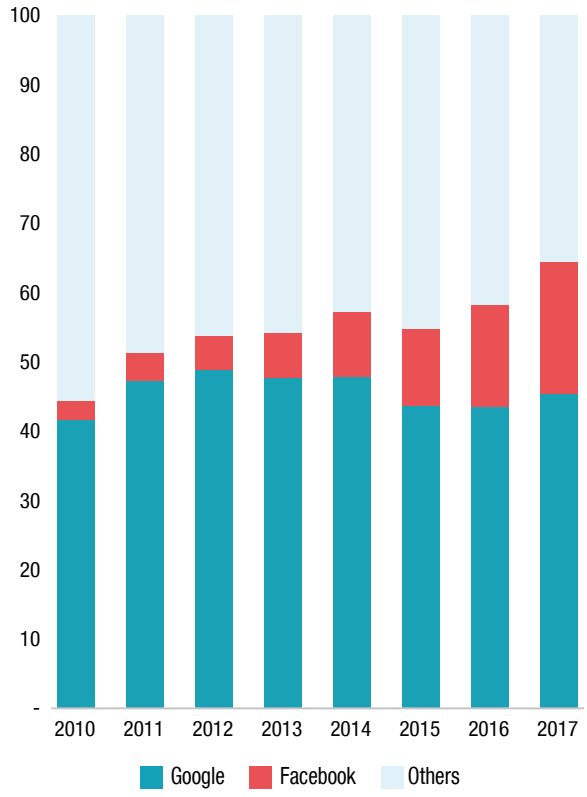
Internet advertising accounts for a rising share of global advertising revenue. It surged from 15 per cent in 2010 to 38 per cent in 2017 to reach about $200 billion. As a result, online advertising overtook television as the largest advertising medium (figure IV.3). This trend seems set to continue: it is expected that digital advertising will account for 60 per cent of all media advertising spending by 2023 (eMarketer, 2019a). Digital advertising spending has also become more concentrated. Google and Facebook, together earned $135 billion in Internet advertising revenue in 2017, corresponding to 65 per cent of the global total (figure IV.4). Their combined share grew by 20 percentage points from 2010, mainly as result of more spending on advertising via Facebook (up from 3 per cent to 19 per cent). In the United States, the same two companies accounted for 61 per cent of all digital advertising revenue. Meanwhile, in Australia, Google's share of revenue from "search advertising" amounted to 96 per cent, while Facebook's share of revenue from "display advertising" was 46 per cent (with no other competitor having more than 5 per cent) (Australia Competition and Consumer Commission, 2018).[95]

Figure IV.3. Global advertising expenditure by different media, 2010 and 2017
(Per cent)



Source: UNCTAD based on ZENITH Advertising expenditure forecasts (https://www.zenithmedia.com), Alphabet Annual Report 10-K (https://abc.xyz/investor/) and Facebook Annual Report 10-K (https://investor.fb.com/financials/default.aspx).

Figure IV.4. Share of Internet advertising revenue, by company, 2010–2017
(Per cent)

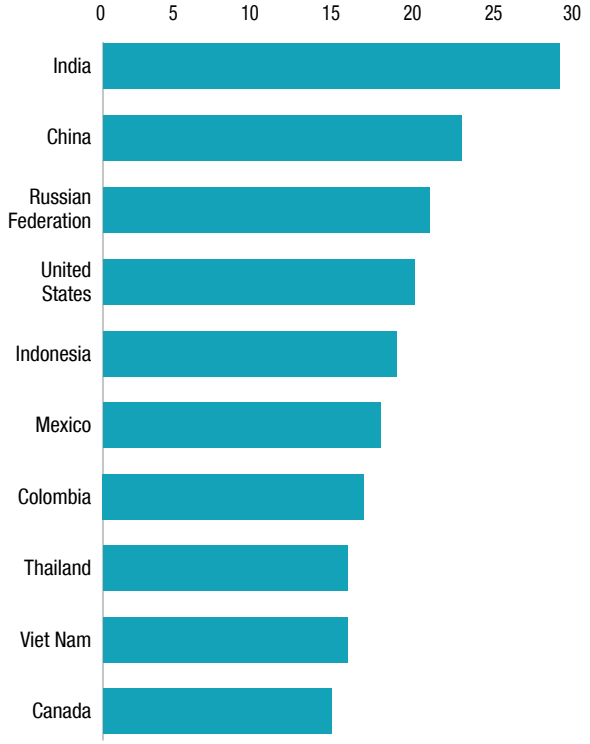


Source: See figure IV.3.

The expansion of these companies into the developing world would give them growing dominance over both the data and the revenue from online advertising. Their immense resources and market power will likely enable them to gather even more data as more users join their platforms, thus further entrenching their position. All the more so, given that digital advertising spending is growing particularly fast in emerging economies (figure IV.5).

Moreover, by capturing ever larger shares of the online advertising market, these companies effectively take away an important source of revenue from other businesses, such as traditional media companies. For example, in the United States, the amount spent on newspaper advertising plummeted from $65.8 billion in 2000 to $23.6 billion in 2014 (Taplin, 2017a) and it is predicted to shrink to only $4 billion by 2023 (eMarketer, 2019b). Potential competitors are also excluded from this business model, and it has been suggested that transaction-based business models (where users pay a fee for the service) may eventually be the only sustainable option for platform-based businesses in most developing countries (Donner, 2018). Compounding this situation is that advertising in developing countries is worth much less than in developed countries, thus exacerbating inequality in potential revenues (Caribou Digital, 2017). Effectively, the global dominance of a handful of platforms may lead to the elimination of a viable business model for competitors and other online services.

Figure IV.5. Estimated growth of spending on digital advertising: Top 10 countries, 2019
(Per cent)



Source: eMarketer, 2019a.

3. Cloud and infrastructure assets

A similar dynamic may hold for cloud platforms, with global providers reaping the rewards of revenue and data, while other companies and countries become increasingly dependent on them. As computing moves to the cloud, these platforms are taking on infrastructural power: they "control the terms of access to, and administration of, infrastructure [and] are in a position to dominate those who depend on that infrastructure" (Rahman, 2018a: 237). There may be particular advantages in the lower level elements of cloud computing[96] since businesses' requirements for these services are broadly the same across sectors. Therefore, global platforms can serve everyone, and can benefit from huge economies of scale (Singh, 2018).[97]

This infrastructural advantage is likely to result in a further concentration of wealth and digital resources. Firstly, cloud companies often earn high margins from their services, extracting a cloud rent by virtue of owning the infrastructure. Amazon Web Services (AWS) is the clearest example of this: between 2013 and 2018, its operating income surged from $0.7 billion to more than $7 billion, thus accounting for a growing share of Amazon's total operating income.[98]

Secondly, there is a comparative advantage built into cloud computing. Proprietary software has been a major competitive leveraging feature for major companies (Bessen, 2017). But if most companies rely instead on standard services from cloud providers, and cloud providers develop their own proprietary software, the latter will offer them a structural advantage.

Finally, cloud computing siphons off data towards the provider. Alibaba has made this explicit with its offers to provide cloud computing services to Chinese convenience stores for "free", in return for Alibaba getting access to the data on offline economic transactions (Hao, 2018). Such data can offer an invaluable competitive advantage. Amazon, for example, is set to provide Chile with cloud computing

for local businesses, for the government, and for Chile's world-leading telescopes. In return, it will receive not only a rent, but also access to key data that could be used to further improve AI and create new services.[99] These examples show three ways in which the use of cloud computing looks set to enable global platforms to capture more value.

E. DIGITAL PLATFORMS AND TAXES

A critical way for most countries to capture value in the digital economy is through taxation. The digital economy can have significant impacts on different types of taxation, including corporate income tax and indirect tax related to e-commerce. This section focuses mainly on the global implications of taxation relating to global digital platforms. One concern is the ease with which they can use tax optimization techniques to avoid paying taxes.

Because of their reliance on intangibles and the ambiguity about where value is produced, they find it relatively easy to shift profits to low-tax jurisdictions (Li, 2014). Global platform companies also often locate their core intangible assets in low-tax jurisdictions. For example, Microsoft holds its software licensing rights in Ireland, Puerto Rico and Singapore. The ability to deliver services over the Internet makes physical jurisdictions less constraining, and transfer pricing through subsidiaries has become increasingly common as a way to reduce the tax burden. The nature of the digital economy enables firms to become leaders in aggressive tax planning, with negative impacts on the tax base of countries.[100]

Developing economies are particularly hard hit, with an estimated $100 billion lost annually due to tax avoidance schemes by MNEs (UNCTAD, 2015c). Moreover, MNEs are more likely than smaller domestic firms to have the resources and capabilities to avoid taxes. As a result, governments are seeking ways to rectify this situation and restore their tax base.

With regard to the concentration of digital advertising revenues noted above, there are potential repercussions for taxation. Because the revenues are rarely reported in the country in which they were earned, few developing-economy governments are able to tax them. For example, most of Facebook's earnings are reported in low-tax jurisdictions. Thus, in 2017, although the company earned 56 per cent of its revenue and 66 per cent of its profit outside the United States, it paid 92 per cent of its taxes in the United States and only 8 per cent in other, mainly developed, countries (table IV.2). In 2017, Facebook announced that it would start to report revenues where earned and where it has a local representative.[101] However, it is not clear whether this will apply to all of its 33 offices around the world, or mainly to those in Europe where it is under the greatest pressure to pay

Table IV.2. Facebook and Alphabet (Google) revenues, profits and taxes, 2017
($ million and per cent)

Facebook	Foreign	United States	Total	Foreign share (per cent)	United States share (per cent)
Revenue ($ million)	22 919	17 734	40 653	56	44
Profits ($ million)	13 515	7 079	20 594	66	34
Share of revenue (per cent)	59	40	51		
Taxes (current) ($ million)	389	4 645	5 034	8	92
Share of profits (per cent)	2.9	65.6	24.4		
Alphabet (Google)					
Revenue ($ million)	58 406	52 449	110 855	53	47
Profits ($ million)	16 500	10 700	27 193	61	39
Share of revenue (per cent)	28.2	20.4	24.5		
Taxes (current) ($ million)	1 746	12 608	14 354	12	88
Share of profits (per cent)	10.1	>100	53.8		

Source: UNCTAD, based on Facebook Annual Report (https://investor.fb.com/financials/default.aspx); and Alphabet Annual Report (https://abc.xyz/investor/static/pdf/20171231_alphabet_10K.pdf?cache=7ac82f7).

taxes. In any case, despite having billions of users of its social media application, the overwhelming majority of developing countries have no physical representation of Facebook.[102] Similarly, the bulk (88 per cent) of Google's taxes in 2017 were paid to the United States, even though that country accounts for less than half of Google's revenues.

F. IMPACTS ON EMPLOYMENT AND PLATFORM WORK

Value creation in the digital economy for individuals, as well as for society, is strongly determined by how digitalization affects employment and working conditions. While global digital platforms are leading in terms of market capitalization, their contribution to direct employment generation is less impressive. For example, Amazon has become the world´s leading retailer, ahead of Walmart, which was originally a brick and mortar retail company. However, with 2.2 million workers, Walmart has four times more employees than Amazon.[103] Beyond the direct employment generated by global digital platform companies, two major questions of interest in this context are whether digitalization is leading to net job gains or losses, and how platform work is transforming the labour market and affecting working conditions. These questions are at the core of the global debate on the "future of work".[104]

1. Impact of digitalization on employment

There are growing concerns that the increased use of various digital technologies will lead to job losses as human work is replaced by automation and AI. Many studies have tried to assess the possible impact, based on different methodologies and covering various geographical areas and time periods. Most of them focus on the risks of job losses without considering the fact that new jobs will emerge in connection with digital disruptions. Similarly, as digitalization is more likely to affect specific tasks than full occupations, the real impact may not be reflected so much in terms of job losses as through changes in the nature of work. Moreover, studies tend to focus mainly on technical feasibility without adequately considering economic profitability (UNCTAD, 2017c); it is only when a technological advance becomes economically feasible that its impact on employment can be assessed.

Predicting what the employment impact of digitalization will be is extremely difficult, and opinions vary.[105] Overall estimates also vary widely, ranging between 9 per cent of jobs at risk of automation worldwide (Arntz et al., 2016) and 47 per cent in the United States (Frey and Osborne, 2013).

From the perspective of "creative destruction" (Schumpeter, 1942), the introduction of new technologies leads to some job destruction as some activities disappear, but also to job creation as new activities emerge. In the short-term job destruction will probably outweigh creation. However, in the long-term, job creation linked to increases in productivity from digitalization may more than compensate for the job losses during the transition period. Thus, digitalization will result in both winners and losers in the job market. A major, still open, question is whether this time will be different from previous technological revolutions due to the rapid pace of technological change, which may make the transition period more painful.[106] The net outcome is likely to be highly contextual, depending on different factors, such as the level of development, production and labour market structures, skills and technological capacities, as well as the social characteristics of each country. It will also depend on the policy actions taken to manage the technological transition period in a manner that enables those losing their jobs to adapt and adjust to the new conditions (UNCTAD, 2017a) (see also chapter VI below).

While the evidence is not conclusive with regard to employment lost through digitalization, there seems to be clearer evidence concerning the impact on inequality. Technological progress in recent years appears to be resulting in greater inequality and labour market polarization (ILO, 2018; Das and Hilgenstock, 2018). Digitalization is increasingly affecting routine tasks that are performed not just by less skilled workers, but also by middle-skilled workers, leading to a hollowing out of the middle class. Moreover, the increasing concentration of digital platforms may weaken the bargaining power of workers. However, technological progress is just one of the factors contributing to inequality. Digitalization may therefore be seen as an additional factor that may be exacerbating worrying global trends in employment and inequality that have been observed since the 1980s.[107]

In developing countries that are lagging far behind in terms of digital readiness, a concern is whether digitalization may erode their comparative advantage. As digital technologies become less costly and more

widespread in developed countries, the abundance of low-skilled and low-cost workers in developing countries may no longer provide a cost advantage in international trade. Producers in developed countries may limit the offshoring of production to lower cost locations or even re-shore their previously offshored production, which may have significant impacts on employment in developing countries and LDCs.[108]

There could also be different gender-related impacts of digitalization. Women could be more affected because they tend to be overrepresented in the performance of routine tasks that are at risk of automation. Moreover, on average, their skill levels, particularly the higher and technical skills that may be required to benefit from the job creation resulting from digitalization, are in many countries lower than those of men. Thus, with technological progress more women may lose their jobs or have fewer opportunities for finding new jobs.[109]

Prospects for employment due to the impacts of digitalization, both for developing countries and for women, are thus uncertain. Overall, while existing evidence may not provide enough support for anxiety or alarm about the employment impacts, policymakers would be well advised to prepare for the potential implications that digital disruptions may have on the future world of work (see chapter VI).

2. Work related to digital platforms

The trend towards greater platformization is being accompanied by transformations in the labour market and the emergence of new forms of employment. In particular, a growing number of people are working for digital platforms on a demand basis, as self-employed, individual contractors or independent workers. While this may provide some advantages in terms of flexibility, it may also result in poorer working conditions. In many cases, while the platform owner retains the same control over the conditions of work as any other employer would, it is the individual worker who bears the negative impact of this working relationship, losing most of the benefits associated with being an employee. Classifications of these kinds of jobs in the digital economy have become a contentious issue, with potential labour rights implications.[110]

Along with the expansion of digital technologies, digital labour platforms emerged in the early 2000s, and have been proliferating ever since. Such platforms connect workers with clients, and set the rules for the exchange and payment of work.[111] Workers' experiences on digital labour platforms vary widely, depending on the characteristics of the individual worker, the reason for engaging in this kind of work, the skills of the worker, whether this is a main or secondary source of income, when the person joined the platform, as well as the availability of other employment opportunities. In addition, workers' experiences vary according to the architecture of the platform.

Choudary (2018) identifies a set of characteristics based on the architecture of digital labour platforms, which gives an insight into the opportunities and working conditions of different platforms. If this is at odds with the ability of workers to exercise agency, differentiate themselves, or improve their earning potential, the platform may exploit rather than empower the workers. The principal features are:

1. *Nature of work and price setting.* In the absence of differentiation and easy substitution, price will be the dominant factor driving consumer decisions, which takes pricing power away from the worker and leads to a loss of free agency.
2. *Ability to encourage repeated exchange*. Platforms that encourage repeated exchange between the same worker and customer may grant greater power to the worker over time than those that repeatedly match customers with new workers. This is often determined by the nature of the work. When the service delivered is commoditized and highly substitutable, customers care less about repeated exchanges with the same worker(s). In general, the potential for repeated exchange and network loyalty is reserved for work requiring specialized knowledge and skills.
3. *Structure of the reputation system.* Labour platforms rely on rating systems to guarantee quality and foster trust among participants. Through rating systems, which require clients to rate or review workers whenever they conclude a transaction, labour platforms have, in effect, outsourced their human resources management. But not all reputation systems are designed in a similar way. On some platforms (for example, Uber), reputation systems are used to discipline workers by threatening their removal from the ecosystem, rather than rewarding the high performers with better pricing power and greater earning potential.

Workers' experiences are also determined by the extent of transparency in the platform's conducting of its operations. Another issue that affects their experience is whether there is a neutral dispute resolution system in place that can arbitrate disputes between clients and workers, or workers and the platform. Currently, it is the platforms that resolve disputes (Agrawal et al., 2013). Given platforms' interests in garnering business, they are unlikely to be able to ensure neutrality when mediating worker-client disputes.

As described above, platforms can be configured in a myriad of ways, and the design of the platform has implications for workers' autonomy and experiences. Depending on the configuration – which relies in part on the types of tasks being offered – workers depend in varying degrees on the platform, but usually less than a self-employed person running his or her own business.

With the aim of better understanding who works on digital labour platforms and their working conditions, the ILO has undertaken several studies of digital workers. The first major study covered 3,500 workers living in 75 countries and working on five English-speaking microtask or crowdworking platforms (box IV.2).

Box IV.2. Experiences of workers on crowdworking platforms: Lessons from an ILO survey

Who are the workers? The survey covered 3,500 workers of all ages with an average age of 33.2 years. One third of those workers were women, but in developing countries, only one in five workers was a woman. Crowdworkers are typically well educated. In addition, 56 per cent of the respondents had performed crowdwork for more than a year and nearly one third had more than three years of tenure.

Why do they undertake this work? The main reasons for doing crowdwork were to "complement pay from other jobs" (32 per cent) or because they "prefer to work from home" (22 per cent). There were some significant gender differences. For example, 13 per cent of women cited as a reason that they could "only work from home" due to care responsibilities, compared with 5 per cent of the men. Ten per cent indicated that they had health conditions that affected the type of paid work they could do. For many of these workers, crowdwork provided a way to continue to work and earn an income.

How much do they earn? On average across the five platforms, in 2017, a worker earned $4.43 per hour when only paid work was considered, and $3.31 per hour when total paid and unpaid hours were considered. Median earnings were lower, at just $2.16 per hour for paid and unpaid work. Nearly two thirds of United States workers surveyed on the Amazon Mechanical Turk (AMT) platform earned less than the federal minimum wage of $7.25 per hour; only 7 per cent of German workers surveyed on the Clickworker platform reported earnings above the German minimum wage of €8.84 per hour for paid and unpaid hours of work. Workers in Northern America ($4.70 per hour) and Europe and Central Asia ($3 per hour) earned more than workers in other regions, where pay varied: in Africa it was $1.33 and in Asia and the Pacific it was $2.22 per hour of paid and unpaid work.

Availability of work. Low earnings were due in part to time spent searching for work. On average, workers spent 20 minutes on unpaid activities for every hour of paid work. The unpaid work included searching for tasks, taking unpaid qualification tests, researching clients to mitigate fraud and writing reviews. Eighty-eight per cent of respondents would like to do more crowdwork – on average wanting 11.6 more hours per week. Workers averaged 24.5 hours per week doing crowdwork (18.6 hours for paid work and 6.2 hours for unpaid work).

One platform or multiple platforms? An insufficient availability of tasks encourages crowdworkers to look for tasks on multiple platforms: almost half the respondents reported having worked on more than one platform in the month preceding the survey. Some 21 per cent had worked on three or more different platforms. Most of the respondents – 51 per cent – worked on only one platform, explaining that this was due to the high start-up and transaction costs of spreading across platforms. More than 60 per cent expressed a desire for more work that was not crowdwork, indicating a high degree of underemployment; 41 per cent were actively looking for paid work other than crowdwork.

Financial dependence on crowdwork. Most crowdworkers depended financially on their earnings from crowdwork, with one-third reporting that it was their primary source of income. For them, income from crowdwork comprised about 59 per cent of their total income, followed by income from a spouse (22 per cent) and another 8 per cent from a secondary job. Respondents for whom crowdwork was not the primary source of income, reported that they earned, on average, as much from crowdwork as from their main job (36 per cent from each); the rest of their household income came from their spouse (18 per cent) or other sources (9 per cent).

Flexibility, asocial hours and care responsibilities. Workers appreciated the ability to set their own schedule and work from home. However, this flexibility was associated with asocial hours: 36 per cent regularly worked seven days per week; 43 per cent worked during the night and 68 per cent during the evening (6 p.m. to 10 p.m.), either in response to task availability (and different time zones) or due to other commitments. Many women combined crowdwork with care responsibilities. One out of five female workers in the sample had small children (0–5 years old). These women nonetheless spent 20 hours per week on the platform – just five hours less than the average for the entire sample – many working evenings and nights.

Types of tasks performed and skill level. The most common tasks performed included responding to surveys and participating in experiments (65 per cent), accessing content on websites (46 per cent), data collection (35 per cent) and transcription (32 per cent). One out of five workers regularly performed content creation and editing, and 8 per cent were engaged in tasks associated with training on AI. Most microtasks were simple and repetitive, and did not correspond to the high level of education of the crowdworkers.

Social protection coverage. In general, social protection coverage among crowdworkers was low. Only six out of ten respondents in 2017 were covered by health insurance, and only 35 per cent had a pension or retirement plan. In most cases, this coverage came from the respondents' main job in the offline economy, job-related benefits of their family members, or State-sponsored universal benefits. Social protection coverage was inversely related to the individual's dependence on crowdwork – those who were mainly dependent on crowdwork were more likely to be unprotected. Only 16 per cent of these workers were covered by a retirement plan, compared with 44 per cent of those for whom crowdwork was not the main source of income.

Rejection, non-payment and communication with platform. Almost nine out of ten workers had seen their work rejected or payment refused. Only 12 per cent of respondents stated that all their rejections were justifiable. Many workers voiced frustration with the inability to appeal against unfair rejections. In addition, the platforms had one-sided rating systems, and mechanisms for evaluating the client/requester were not in place. Workers also struggled to communicate with requesters and platforms. Many workers (28–60 per cent, depending on the platform surveyed) had turned to worker-run online forums and social media sites to seek advice from fellow crowdworkers or follow discussions about issues facing crowdworkers.

Source: Berg et al., 2018.

G. CONCLUDING REMARKS

Digitalization affects most productive processes and activities in an economy, involving products in all sectors, from agriculture to services. The world is currently only in the early stages of this transition. The market's invisible hand seems set to become a digital one, increasingly managed by major digital platforms. Some of them have already achieved global reach in their respective business areas. The rising value of data and digital intelligence is reflected in their high market capitalization values. Their growing role has far-reaching implications for the organization of economic activities. Moreover, the data-centric business model is being adopted not only by digital platform companies, but also increasingly by lead companies across all sectors.

With data-enabled digital intelligence becoming a central factor of production, its application for value creation and the control of its value capture increasingly define the global economy. Under the status quo, global digital platforms could grow even more dominant. It is important to understand fully the implications of this new model of economic organization for the global economy, and particularly for developing countries. Digitalization and global digital platforms have significant implications for competition and international taxation, as well as for employment and platform work that need to be considered.

With regard to the global data value chain, as well as some specific, related value chains, such as advertising platforms and cloud infrastructure provision, developing countries could become stuck in subordinate positions, with value and data being centralized in existing global platforms. This may result in the emergence of a new kind of international dependency pattern, with developing countries having to rely mainly on global digital platforms based in the United States or China. In the global data value chain, developing countries risk becoming mere providers of raw data to global digital platforms, while having

to pay those platforms for the digital intelligence they produce from those data. This would do little to reverse the current trends of rising inequalities. If anything, it might exacerbate them.

Developed countries are in many ways better prepared to respond to challenges associated with the growing role of digital platforms than countries that have limited resources and capacities. The latter's lower degree of preparedness may relate not only to connectivity, technological, financial or logistical aspects, but also to weak regulatory and institutional capacities (chapter VI).

Nevertheless, there may still be important benefits for local firms in developing countries that are able to take advantage of the services offered by global platforms. For instance, e-commerce platforms may provide export opportunities for MSMEs, enabling them to reach beyond small domestic markets. Using existing payment and e-commerce platforms can enable MSMEs to boost their sales, especially if they cater to certain niche markets (Singh, 2018; UNCTAD, 2017a). In this case, MSMEs could rely on the global e-commerce platforms to access new buyers, but would not compete with the platforms. In some cases, the need for local knowledge (e.g. search habits, traffic conditions, cultural nuances) might give an advantage to locally rooted platforms, enabling them to offer better services to local users (chapter V).

In other cases, some platform companies are "globally local". For instance, while the network effects of Facebook are broadly global (more users in one country will make the platform more attractive to people in other countries to also join), the network effects of Uber are largely specific to the city in which it operates. The network effects established in London, for example, are significantly weaker in Cape Town.[112] This means that "globally local" platforms have to recreate network effects each time they move into a new area, and may therefore face more local competition than platforms that can provide all services without a local presence.

However, due to the monopolization dynamics referred to in this chapter, local platform competitors in developing countries will mostly face an uphill battle. This raises a number of questions: What chance of success does a local cloud provider have against Amazon Web Services or Alibaba Cloud? What are the chances for homegrown ride-sharing services to compete when Uber or Didi arrive?[113] How may a start-up social network compete with Facebook?

Thus, notwithstanding potential benefits that may arise for developing countries, what emerges from this chapter is that, under current regulatory settings, the existing trajectory of the data-driven economy suggests that it is unlikely to contribute to the attainment of the SDGs. The increasing dominance of global digital platforms and their control of data, as well as their capacity to create and capture the ensuing value, is likely to further accentuate increasing inequalities in the global economy, both between and within countries. Breaking the vicious circle will require thinking outside the box to find alternative configurations of the digital economy that could lead to more balanced results and a fairer distribution of the gains from data and digital intelligence. This will be a task for policymakers, as discussed in chapter VI.

Notes

65 This study covered 242 platform companies with a reported private valuation or a public market capitalization of at least $100 million.

66 See *The Wall Street Journal,* 25 April 2019, Microsoft Hits $1 Trillion Market Value for First Time.

67 See *The Economist,* 28 May 2016, Taming the beasts.

68 See *The Economist,* 11 May 2019, Lyft's revenues double, losses quintuple—and prospects darken.

69 See *Bloomberg*, 21 March 2018, Flipkart's losses have wiped out half of $6.1 billion injected by investors; and *The Hindu BusinessLine*, 15 January 2018, Amazon India headed for $1 b loss in FY17.

70 For the example of Monsanto, see Bayer, 4 January 2018, Coming soon: Better, more sustainable and integrated innovations for the farm" at https://monsanto.com/innovations/research-development/articles/farm-innovations/; for GE, see *MITSloan Management Review*, 18 February 2016, GE's big bet on data and analytics; and for Intel, see *The Circle*, 16 November 2018, "We are more data centric than hardware driven".

71 Facebook is also the most used social network in 92 per cent of all countries (Cosenza, 2018).

72 Data on market shares are from *The Economist*, 28 June 2018, How regulators can prevent excessive concentration online. See also UNCTAD, 2019a; and Internet Society, 2019.

73 See *Digital Marketing China,* 30 December 2018, Meet B.A.T, China's three big data titans – Tencent.

74 See *New York Magazine*, 12 December 2017, Can Facebook and Google be disrupted?

75 See *Adweek*, 12 January 2018, On Facebook's nuclear bomb.

76 By offering users a virtual private network (VPN), Facebook can monitor how people are using their phones, and to spot rising start-ups and popular features before they become rivals. The app was reportedly used in the decision to buy WhatsApp. See *Wall Street Journal*, 9 August. 2017, The new copycats: How Facebook squashes competition from startups.

77 See *CBInsights,* The Google Acquisition Tracker, at: https://www.cbinsights.com/research-google-acquisitions.

78 Acquisitions for which the target and acquirer have the same parent company are also excluded.

79 Calculation based on end of opening day price compared with the stock price in November 2018.

80 See *The Economist*, 7 December 2017, Google leads in the race to dominate artificial intelligence.

81 See *The Wall Street Journal*, 20 August 2011, Why software is eating the world.

82 See *The Wall Street Journal*, 8 September 2017, Facebook is willing to spend big in video push.

83 See *The New York Times*, 1 July 2017, Inside Yelp's six-year grudge against Google.

84 See also *The New York Times*, 25 June 2018, How Amazon steers shoppers to its own products.

85 See *The Wall Street Journal,* 19 September 2018, EU starts preliminary probe into Amazon's treatment of merchants.

86 See *Reuters*, 20 November 2017, Volvo cars to supply Uber with up to 24,000 self-driving cars.

87 See *Tech Crunch*, 22 August 2017, Walmart and Google partner on voice-based shopping.

88 See *Livemint*, 8 January 2019, Intel working with Facebook on AI chip coming later this year.

89 Amazon has sought a patent for predictive purchasing to deliver the goods people like even before they order them (Simpson, 2016).

90 See *The Wall Street Journal*, 28 November 2016, The invisible digital hand.

91 See *BuzzFeed,* 24 January 2017, SpaceX, Uber reach new heights in lobbying spending.

92 Additional concerns include the absence of regulations, lax rules relating to government procurement, tax policies that facilitate transfer pricing and subsidiaries, and prohibitions of technology transfer.

93 See *Financial Times*, 5 July 2017, Baidu offers open-source car software as lure for data.

94 See *The New York Times*, 27 November 2018, How cheap labor drives China's A.I. ambitions.

95 See also *The Wall Street Journal*, 27 November 2018, Amazon, with little fanfare, emerges as an advertising giant.

96 Cloud computing is traditionally divided into infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS) (UNCTAD, 2013). The former two are lower level in the sense of being further away from the user interface, and are typically more generic than the more localized SaaS.

97 A company like Amazon is also moving further into the infrastructure business by offering, for instance, logistics/retail as a service. Third parties can now use the site to sell as well as to use the warehouses and the delivery system handled by Amazon. See *The New York Times*, 9 February 2018, Amazon to test a new delivery service for sellers.

98 See *ZDNet*, 31 January 2019, In 2018, AWS delivered most of Amazon's operating income.

99 See *Reuters*, 4 September 2018, Amazon eyes Chilean skies as it seeks to datamine the stars.

100 See *Wall Street Journal*, 18 December 2017, Tax plan strikes at tech giants' foreign profits; and *The New York Times*, 25 May 2013, Across U.S. companies, tax rates vary greatly.

101 See, for instance, *New Vision*, 19 April 2018. Levy new social media tax on Facebook… not users.

102 The locations of Facebook can be found at: https://www.facebook.com/careers/locations.

103 See *Forbes*, 15 May 2019, Amazon surpasses Walmart as the world's largest retailer.

104 See, for instance, ILO, *The Future of Work,* at: https://www.ilo.org/global/topics/future-of-work/lang--en/index.htm.

105 See various literature reviews of different studies on the impact of digitalization on employment (e.g. Balliester and Elsheikhi, 2018; Eurofound, 2018a; Royal Society and British Academy, 2018; and Freddi, 2017).

106 See also UNCTAD, 2017a.

107 See UNCTAD, 2010 and 2012b.

108 Given the greater adoption of digital technologies in developed countries, most analyses of the impact of digitalization on employment have been focusing on these countries. However, with the digital economy also spreading to developing countries, studies are increasingly looking at the employment impacts there as well. See, for instance, African Development Bank et al., 2018; Schlogl and Sumner, 2018; Dutz et al., 2018; Melia, 2019; ADB, 2018; Bertulfo et al., 2019, and IDRC, 2018.

109 For detailed discussions on the gender-related impacts of digitalization on employment, see Hegewisch et al., 2019; Brussevich et al., 2018 and 2019; and Florito et al., 2018.

110 For detailed discussions on platform work, see the ILO study on "Crowdwork and the gig economy" at: https://www.ilo.org/global/topics/non-standard-employment/crowd-work/lang--en/index.htm, Eurofound, 2018b; OECD, 2016c; European Commission, 2018.

111 See also UNCTAD, 2017a.

112 There may be some transference of network effects from one city to another, given that tourists and business travellers may tend towards the platforms they are familiar with. Yet these groups account for a relatively small proportion of the overall users of ride-sharing.

113 An interesting natural experiment took place in Austin, Texas (United States) where Uber and Lyft were briefly restricted from the city and local alternatives flourished. Since Uber and Lyft were allowed to return, however, the main competitor has lost 70 per cent of its ridership and remains unprofitable. See *Austin American-Statesman*, 3 May 2018, RideAustin battles to survive in space dominated by Uber, Lyft.

This chapter discusses the scope for developing countries to create and capture value domestically in the digital economy, in areas where the main opportunities may be found. Clearly, owing to their varying levels of development and digital readiness, the challenges for achieving this vary considerably by country. For example, China is a developing country but also a leading economy in terms of its level of digitalization. On the other hand, countries in Africa are trailing the furthest behind in this respect. Drawing on recent empirical research, the chapter analyses developing countries' track record to date in value creation and capture in the digital economy with special attention to Africa.

ASSESSING THE **SCOPE** FOR VALUE CREATION AND CAPTURE IN **DEVELOPING** COUNTRIES

5

OPPORTUNITIES AND LIMITATIONS IN DEVELOPING COUNTRIES

Opportunities for MSMEs...

Small businesses can leverage global platforms, but only if they are accessible.

By strengthening **domestic productive capacity**

More value can be captured in the digital economy

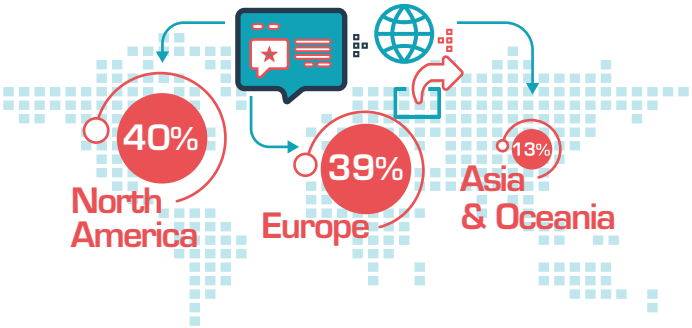
Main growth opportunities: enter a **new product category** or find **market niches** that globally operating platforms are unable or unwilling to address.

...despite bottlenecks and uneven distribution of activity

Market and infrastructure barriers when trying to scale

In **2015** only **2 platforms** in **Africa and Latin America** with a valuation of > **$1 billion**

Highly uneven distribution of content created online



High concentration of innovation and entrepreneurship activity in all regions

Digital entrepreneurship in Africa

60%
Egypt, Kenya, Nigeria and South Africa

Start-ups in Asia

58%
China and India

In **Latin America**, leading start-up cities include Buenos Aires, Bogota, Mexico City, Lima, Santiago and Sao Paulo.

Digital entrepreneurship bottlenecks in developing countries

Limited demand

Entrepreneurial knowledge and skills

Skilled workforce

Finance

Innovation hubs can make important contributions but often fail to deliver.

More attention is now given to **direct interventions**, supplying promising startups with capital and networks.

Platforms in developing countries, and especially in Africa, cannot be as **"physical-asset light"** as their global counterparts.

To capture the opportunities for developing country enterprises in the digital economy, deficiencies in infrastructure and entrepreneurial ecosystems need to be addressed. The scope for the value creation and capture is enhanced if domestic firms have resources, skills and awareness needed to transform digital opportunities into greater competitiveness.

A. THE IMPORTANCE OF BUILDING DOMESTIC PRODUCTIVE CAPACITY

When considering the relationship between the digital economy and economic development, it is useful to differentiate between first- and second-order benefits.[114] First-order benefits relate to direct and visible advantages of access and use of digital technologies by users, enterprises and governments. Such use can create value in terms of increased competitiveness, productivity, wealth and well-being. However, as access and use of standardized and general-purpose technologies become more widespread, they become less of a distinguishing factor for boosting competitiveness. This is because, with more actors using a certain technology, latecomers may have to adopt it to stay in the market, but this will not necessarily give them an edge over their competitors. For example, early adopters of e-commerce may gain more of a competitive advantage than those that jump onto the bandwagon at a later stage. For latecomers it becomes more of a requirement than a distinguishing factor.

Second-order benefits stem from the development, management and distribution of digital technologies and services. These create better prospects for long-term growth, job and wealth creation, and lasting positive effects on productivity and competitiveness. The greatest value in this context is likely to emanate from the monetization of large-scale digital data. As a result, while first-order benefits may yield decreasing returns as technology use becomes more widespread, second-order benefits can result in increasing returns. For example, the more companies and consumers that use an e-commerce platform, the more attractive that platform becomes due to network effects.

In the digital economy, most enterprises are *users* of digital products, thus potentially benefiting from first-order effects. A much smaller number of enterprises are involved as technology and digital services developers, distributors and managers. In order to harness the full potential of the digital economy for value creation, developing countries need to look for ways of deriving both first- and second-order benefits.

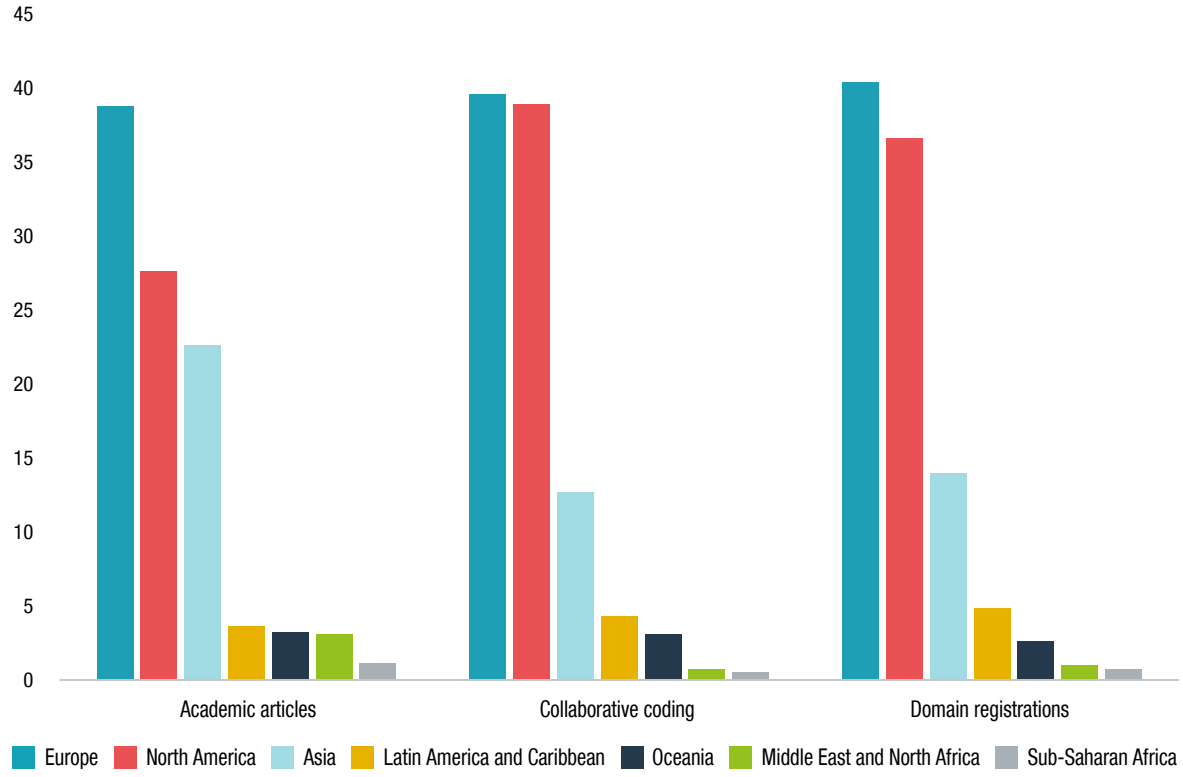
Digital entrepreneurship and innovation can boost domestic economic development (see, for example, Broadband Commission, 2018).[115] This can take the form of local actors creating new digital technologies or adapting existing ones, or pursuing technology-based market opportunities, or from digitalization of existing economic activities (i.e. local actors using digital technologies developed elsewhere to improve previously analog-based business processes). The digital economy may enable entrepreneurs in developing countries to enter new markets (e.g. through e-commerce). The application of new technologies may also lead to the emergence of new business models and to new solutions to long-standing development challenges.

UNCTAD (2018e) has highlighted the relationship between entrepreneurship and structural transformation, including aspects related to the digital economy. However, the extent to which this translates into real benefits depends to a large extent on the ability of entrepreneurs to develop the underlying digital technology domestically, and their ability to scale. This, in turn, is determined by local conditions and relevant domestic and international policies (chapter VI). The purpose is essentially to create domestic spillovers from digital entrepreneurship and innovation. Thus, the capacity to generate local content in the digital economy becomes crucial.

Local content can be linked, for example to the domestic production of software in developing countries (UNCTAD, 2012a). As a general-purpose technology, software has wide applications throughout an economy: it can help firms manage their resources better, access relevant information, lower the costs of doing business and reduce time to market. Increasing emphasis on ICTs in the delivery of government services, health care, education and other services is also creating a greater need for capabilities to develop customized software applications. Countries with well-developed software industries are better equipped to implement tailored solutions and to generate learning opportunities, in addition to improving productivity and operational efficiency.

Local-content generation may also involve the building of ICT and other infrastructure in the digital economy, or the creation of content in local languages. Currently, the generation of content in the digital economy (e.g. academic articles, collaborative coding and domain registrations) is extremely uneven geographically (figure V.1). It is highly concentrated in developed countries and those in Asia, but it remains limited in all other developing regions. It is therefore important for most developing countries to develop their productive capabilities for the digital economy. This concerns not only creating digital platforms, but also facilitating digital entrepreneurship and the digitalization of existing firms.

Figure V.1. Online content creation, by geographical region
(Per cent)



Source: Ojanperä et al., 2017.
Note: Regions are those used by the source.

Against this background, the remainder of this chapter begins by examining potential opportunities for developing-country firms to make use of global digital platforms. Section C explores the potential for local and/or regional platforms to emerge and thrive in developing countries. Section D discusses current trends in and opportunities for digital entrepreneurship in developing countries, drawing on available research, especially for Africa. Section E examines the digitalization of enterprises in developing countries, and the final section concludes.

B. THE USE OF GLOBAL DIGITAL PLATFORMS IN DEVELOPING COUNTRIES

There are various ways in which firms in developing countries can benefit from the use of global digital platforms. Greater opportunities to connect with different parts of a country, or with other countries, could result in improved efficiency and increased access to domestic and international markets.

Some global digital platforms may provide more potential for economic value creation than others. However, the distinction between different platforms is becoming increasingly blurred. In many developing countries, Facebook is often used as a means to market domestic services to potential customers. New digital solutions, including for e-commerce, are creating opportunities for companies of all sizes to engage in domestic and international trade, notably by increasing market access for customers, supply chains and competitors, and by lowering trade costs. In addition, by reducing transaction and search costs, as well as frictions, digital platforms enable those offering assets or services to connect more easily with (potential) consumers. This has not only resulted in new types of trade (in digitally traded products, services and tasks); it has also enabled more traditional trade to move online and leverage different digital platforms

to better match buyers and sellers, and make their products more visible.

This can have a positive impact on MSMEs in countries at all levels of development, but in different ways. Potential benefits for developing-country companies and consumers range from greater efficiencies to deeper specialization and division of labour, gains from variety and predictability for all players, as well as lower costs and prices of inputs and final products.

However, in order to be able to benefit from e-commerce, developing countries need to address a number of areas, notably: fostering the provision of affordable ICT infrastructure and services, offering payment solutions, improving trade logistics and trade facilitation, creating appropriate legal and regulatory frameworks, promoting e-commerce skills development, and facilitating access to financing (UNCTAD, 2015d). All these will contribute to improving the readiness of developing countries to trade online. Current wide variations in e-commerce readiness, between and within countries, enhance the risk of benefits from e-commerce being unequally distributed (see also chapter VI).

Moreover, for development purposes, global e-commerce platforms should be leveraged in developing countries not only for buying and importing foreign products, but also for supporting domestic production and exports. Although statistical data to permit an analysis of developments in this regard are not available, there are indications that, so far, global e-commerce platforms in developing countries have been more effective in facilitating imports of foreign products than in enabling domestic products to be exported. Consequently, many developing countries are increasingly concerned that a greater reliance on global e-commerce platforms will mainly result in higher consumer spending and imports.

For developing countries to benefit fully from global platforms, their entrepreneurs and enterprises need to have easy access to them, both as buyers and sellers. Firms in developing countries are sometimes restricted in their use of platform services, and access to many platforms remains uneven (UNCTAD, 2015d; Kende, 2015 and 2017). A common factor limiting access to e-commerce platforms is the lack of cross-border payments solutions. While global e-commerce platforms provide integrated payments solutions, in many developing countries, companies are unable to use them if they lack the requisite foreign bank account or subsidiary. Similar asymmetries have also been observed with regard to selling mobile applications in sub-Saharan Africa, for example. Moreover, the largest advertising platforms, such as Google AdSense, do not accept advertisements in African languages other than Arabic, English, French and Portuguese, which limits the potential to monetize new services (UNCTAD, 2018b).

Global digital platforms, if accessible, may be useful by providing a sort of infrastructure on which innovation and digital enterprises can be developed, thereby serving as building blocks for local entrepreneurship, and enabling creativity to be exploited. Box V.1 describes the specificities of innovation and entrepreneurship in the digital economy.

The distinction between transaction and innovation platforms is relevant in this context (chapter II). While transaction platforms create a virtual environment to facilitate direct interactions between users, innovation platforms create environments for code and content producers to develop applications and software. Transaction platforms (e.g. AirBnB or Facebook) seek to engage as many end users as intensely as possible, mining and processing user data to monetize value (Srnicek, 2017). These kinds of platforms have captured most of the public and policy attention, most likely because they are better known and they offer more immediate interaction between end users and workers.

However, innovation platforms (such as Android or iOS operating systems) are arguably at least as important for examining the relationship between the digital economy and development. They are building blocks, and highly interconnected gatekeepers, for generative digital innovation processes (Gawer, 2014; Henfridsson and Bygstad, 2013). Innovation platforms pursue different and often more complex design strategies directed at innovators (e.g. focusing on application programming interfaces (APIs) and technological standards), with the ultimate goal of establishing extensive, yet seamless, innovation ecosystems (Gawer and Cusumano, 2014). Providers that combine innovation and transaction platforms can be referred to as “integrated platforms” (e.g. Google and Apple) (Evans and Gawer, 2016). It is therefore important to distinguish between companies and products: a single company (Google) may offer a range of products that can be both transaction

Box V.1. Digital innovation, products and entrepreneurship

There is an extensive body of literature on digital innovation, products and entrepreneurship. Digital and digitized products have layered or layered-modular architectures, with important consequences for firms' organization and strategies (Yoo et al., 2010). While traditional industrial products follow modular and integrated architectures (e.g. a car, which is an assembly of a number of modules that are themselves produced in linear value chains), digital technologies are typically organized in layers (devices, networks, services and content). Those layers are loosely coupled: they function independently, but standards and interfaces ensure interoperability (Straube, 2016; Tilson et al., 2010).

Digital innovation tends to progress in separate, layer-internal evolutionary processes (Fichman et al., 2014; Nambisan et al., 2017). These are particularly scalable and dynamic within the service and content layers, as the digital products consist of software stacks (made up of code) and data. This makes combinatorial innovation easy and cheap, as new products can be assembled by scattered individual software developers or by joining existing companies' software stacks (Gao and Iyer, 2006; O'Mahony and Ferraro, 2007).

Ultimately, digital innovation progresses "generatively": as ever more building blocks of digital products become available, more possibilities for reassembling them open up, without the need to involve the creators of the original digital products (Zittrain, 2009). Digital innovation has thus become a highly dynamic, geographically distributed, multi-faceted process with myriad actors participating in different strands of activity. Standards and collectively accepted features (e.g. brands and norms) play an important role in enabling digital innovation across time and space.

This does not mean that any digital technology component can be combined with any other. Instead, innovation in different types of digital technologies evolves along paths, allowing digital building blocks to become more specialized and sophisticated (Henfridsson et al., 2009). These paths can lead to the emergence of rather independent digital technological fields, such as 3D printing, sensors, IoT, drones and blockchains (see, for example, UNCTAD, 2017a and 2018a).

Digital entrepreneurship refers to the market-opportunity-oriented, actor-driven creation of digital products (Nambisan, 2017). A new digital product can emerge as an entirely new digital technology, but more often it is the result of entrepreneurs recombining and adapting existing technologies to new market contexts (Beckman et al., 2012).

Source: UNCTAD.

platforms (e.g. Google Search or Gmail) and innovation platforms (e.g. Android or Google APIs) in their own right.

As digital innovation often happens generatively, foundational digital building blocks remain in use without entailing any further action and cost for their creators. Especially when a digital product becomes embedded in global digital infrastructure, it can scale together with the overall digitization process (Henfridsson and Bygstad, 2013). This scaling mechanism applies to innovation platforms that create ecosystems for both combinatorial digital innovation (e.g. iOS, Android, Microsoft, WordPress, SalesForce, Ruby on Rails, GitHub) and other digital infrastructure products (such as those offered by Intel, Akamai, Huawei, Tencent, Amazon Web Services, Qualcomm, Ericsson, Oracle, Adobe and Mozilla). Hence, it is important for entrepreneurs and innovators to have the necessary access and skills to leverage these critical digital building blocks.

C. LEVERAGING LOCAL AND REGIONAL DIGITAL PLATFORMS

This section considers the scope for developing countries to leverage the opportunities for establishing local and regional digital platforms. Such platforms can offer some potential advantages to the domestic real economy, including convenience for local consumers and businesses through shorter shipping times, flexible payment options, relevant products and local language interfaces, better linkages with local industries and suppliers, reduced reliance on imports and greater openness to support exports. However, they often face a number of constraints due to weaknesses in the local economic environment. This helps to explain why digital platforms originating in developing countries have remained fewer and smaller than their counterparts in the more advanced economies.[116]

1. Features of local and regional digital platforms

A consistent finding concerning digital platforms originating in developing countries is that most of them are transaction platforms rather than innovation or integrated platforms. The rising number of platforms in Asia (excluding China) fall wholly in the transaction platform category, and they have relatively low levels of market capitalization. In Africa and Latin America, there were only two platforms with a valuation of at least $1 billion in 2015, and together they represented less than 1 per cent of all platforms by number and market valuation (see also chapters I and IV).

Using desk research to compile data covering 42 platform companies that had raised $1 million or more in investments in Africa, David-West and Evans (2015) found that all were transaction platforms.[117] Among these, e-commerce platforms, sites for classified advertising and job boards, as well as emerging financial technology companies accounted for most of the cumulative market valuation. Two African investment companies have major shares in many of the leading platforms: Naspers (including OLX, Konga, and Takealot) and One Africa Media Group (including Cheki, Jobberman, and BrighterMonday). Another example is Rocket Internet (through its holding company Africa Internet Group), based on a more controlling yet flexible venture builder model (Baumann et al., 2018). It has invested in a number of e-commerce platforms, such as Carmudi, Lamudi, Hellofood and Easy Taxi, many of which have been consolidated under the Jumia Group brand.

African digital platform entrepreneurs face specific market and infrastructure challenges that require critical adaptations compared with business models used by global platforms. The following are examples of such adaptations:

- Having a person to function as the customer's interface with the digital platform. This may involve sales or extension agents using tablets to facilitate data entry, allowing cash payments on delivery, building up local call-centre capacity for quick call-backs and customer service.
- Establishing physical supply-chain and logistics services, such as distribution centres, payment points, warehouses, drivers and delivery vehicles.
- Consolidating and sharing physical supply-chain and logistics services across different e-commerce verticals.
- Using text messages and Unstructured Supplementary Service Data (USSD) codes (i.e. analog-era communications technology), for offline orders and confirmations, for example.
- Investing in the development of human capital (e.g. project managers and software engineers).
- Investing in the development of entrepreneurial and managerial knowledge, such as understanding Africa-specific launch and competitive strategies or pricing.

Due to the weaknesses in the local ecosystem (e.g. poor bandwidth and reliability, or inefficient payment systems) and low technological capacity of customers and employees, and/or issues with physical logistics (e.g. delivery services), digital platforms in developing countries have to employ a range of business-model innovations to be viable.

The value proposition for the end user on digital platforms in developing countries is often the same as for the global digital platforms (for example, ordering an electronic item for home delivery on Konga vs. on Amazon). However, the way they assemble the value proposition differs significantly. The value chain of the former involves intricate and cumbersome offline development of capacity, supply chain processes and logistics infrastructures. This increases the operating costs and reduces the potential for shared value creation and digital scaling (e.g. letting users independently upload content, or automated analysis of user data). Accordingly, African platform businesses face a tough challenge: they may have to seek higher margins (e.g. charging higher commission fees on transactions) in an environment where the willingness, and most importantly the capacity, to pay is relatively low. In effect, this makes user-base scaling difficult.

As a consequence, many digital platforms in developing countries, and especially in Africa, have to internalize a greater share of the overall value creation, and cannot afford to be as "physical-asset light" as their global counterparts (chapter IV). Online-offline dynamics have been identified as a key feature of platforms in Africa (Insight2Impact, 2019).[118]

From around 2012, when broadband Internet became more widely available, companies started to occupy verticals, such as food delivery, travel, car purchases, real estate and electronics, in large and fast-growing markets, including in Ghana, Kenya and Nigeria. While most of these companies span most of Africa, their operational centres are found in only a few locations,

such as Lagos for West Africa, Nairobi for East Africa and Cape Town for Southern Africa (David-West and Evans, 2015). Moreover, several e-commerce providers have had to roll back their activities. For example, Jumia has been experiencing significant losses, reportedly leading Rocket Internet to withdraw as its lead investor (Akinloye, 2018). However, this can also be considered part of the strategy described in chapter IV, of investors in platform companies prioritizing growth over immediate profits. Indeed, Jumia has emerged as the main e-commerce platform in Africa, operating in more than a dozen countries, though it may face scaling problems due to lack of interoperability among countries. In 2016, it was the first African start-up company to achieve a valuation of $1 billion, and in April 2019 it became the first company in Africa to launch an initial public offering (IPO) in the United States.[119]

Similar constraints as those faced by African countries to develop local digital platforms have been observed in Latin America, though to a lesser extent. For example, the connectivity situation is better in Latin American countries. Among the examples of successful platforms in this region, the Argentinean e-commerce platform, MercadoLibre operates in many Latin American countries. The Colombian on-demand delivery startup, Rappi, has also exceeded the $1 billion valuation to qualify as a "unicorn". Indeed, Latin America has shown stronger dynamism in the development of technology companies, giving rise to the specific term of "technolatinas", defined as technology-based private companies born in that region. Arrieta et al. (2017) identified 123 technolatinas worth over $25 million and 9 unicorns worth over $1 billion. Most of these companies were concentrated in Brazil, Argentina and Mexico. By April 2019, Latin America had 19 unicorns.[120]

In Asia, the digital platform landscape is dominated by China. Apart from the successful Chinese platforms, most of the dynamic digital platforms in developing Asia have been observed in India and in South-East Asian countries. Platform companies are relatively dispersed across the region, and are somehow more integrated at the regional level than in Africa. As in other regions, a few locations stand out: Beijing, Shanghai and New Delhi (Evans, 2016).

In terms of competitiveness, the numerous analog challenges are both a blessing and a curse for regional digital platform providers in developing countries. In a range of verticals, regional platforms are already competing with global incumbents, especially for e-commerce (FlipKart vs. Amazon), travel and accommodation (Jumia Travel vs. AirBnB, Hotels.com), multimedia entertainment (iRokoTV vs. YouTube, Netflix), and ride-sharing (LittleCab vs. Uber). In these segments, the fact that the digital ecosystems in developing countries' cities are not on par with the conditions that global platforms rely on, can open up somewhat "protected" market niches for local and regional platforms. On the other hand, the scope for developing-country competitors to achieve exponential growth via user-base scaling is greatly constrained.

2. Drawbacks from the lack of innovation platforms

The lack of digital innovation platforms in many developing countries has significant development implications. One possible outcome is that the dominance of global innovation platforms will further fortify technological innovation pathways that may be poorly aligned with local market needs in the developing countries. Furthermore, digital enterprises in developing countries may find themselves at a competitive disadvantage, thus hindering their ability to scale. And locally appropriate digital technologies may continue to be hard to create due to a lack of (or weak) suitable foundational digital building blocks for combinatorial innovation.

Global innovation platforms are likely to remain at the technological frontiers that offer the greatest relevance and payoffs at a global scale. These include cutting-edge technologies with vast potential for commercial application (e.g. AI, virtual reality, self-driving cars and IoT). If these platforms and other digital infrastructures are developed for the creation of ever more advanced smart manufacturing products, they are unlikely to also be interested in the creation of simpler, cheaper, more robust innovations suitable for manufacturing plants that have not yet upgraded to the previous stage of digital evolution (Henfridsson et al., 2009; Yao et al., 2017). This may accentuate the risk of many developing countries falling further behind in the digital economy.

Moreover, the opportunities for local digital innovation platforms to emerge in developing countries may also become slimmer over time as the market and innovative powers of global platforms are reinforced. Countries trailing in the digital economy may not only find it virtually impossible to catch up with the more advanced economies; they may also lose the ability

to develop indigenous innovation ecosystems if the critical mass of resources (e.g. users, financial capital and data) and developer capacity are increasingly concentrated on technology designed primarily for the needs of other geographical areas.

The African mobile money and smartphone app, M-Pesa, can serve as an example. It is a widely celebrated success story of an African innovation with mass adoption and clear wealth effects (Mbiti and Weil, 2011; Morawczynski, 2009). Yet in interviews, digital entrepreneurs have expressed concerns about the low degrees of openness and functionality of M-Pesa's API, which prevents them from introducing digital innovations that would build on its platform. Outside Kenya, the situation is even more challenging, with the electronic payment landscapes being fragmented between mobile operators with clunky APIs, international payment providers requiring credit cards or bank accounts (or being entirely blocked), and fintech start-ups lacking a user base, capital and influence.

Another complication is the many different generations of feature phones and smartphones that are in circulation, often running on obscure or outdated versions of Google's Android or Nokia's Symbian operating systems. Furthermore, smartphones and related applications are often ill-suited to African cities, with batteries overheating, thus shortening their lifespan, and having apps that require too much bandwidth and lacking in offline functionality. In such an environment, digital innovation cannot be conducted by scattered actors, and it cannot unfold its combinatorial potential as easily. The existing agreed-upon standards and facilitating virtual environments (i.e. innovation platforms) may not be suitable for local conditions. Moreover, localized standards and platforms are fragmented so that they are unable to function as digital infrastructure and reach the critical mass needed to benefit from network effects.

3. Limited growth potential of local and regional digital platforms

Digital platforms in developing countries are on the rise in terms of numbers, size and scope, some of them even reaching billion-dollar valuations, especially in Asia (mostly Chinese platforms), but also in Latin America and Africa. However, various factors related to geographically layered competitive dynamics in digital platform markets may affect their continued expansion. Given the scaling economies and lock-in effects of digital platforms, developing-country start-ups often find it hard to compete effectively for markets/product categories that are offered through the physical-asset-light expansion strategies of global competitors. Consequently, the main growth options left to them are either to enter a new product category (digital innovation), or to look for niche markets that globally operating platforms are unable or unwilling to serve (differentiation). In the absence of adequate regulations and protections, competing head-on with platform incumbents is rarely an option.

Paradoxically, the distance-bridging potential of digital technologies may therefore have the opposite of a levelling effect on platform market opportunities. The more a product category is dependent upon a transnational user base and/or generativity scaling, the more likely it is to be dominated by digital enterprises starting in places with higher levels of financial resources, entrepreneurial knowledge and human capital. Instead, it is in digital product categories that depend on incomplete and fragmented analog infrastructures that developing countries' digital platforms stand a chance to compete. In this case, they may provide a value proposition, albeit at a higher operating cost, that would not otherwise be available to local customers.

As foreign incumbents do not find it cost-effective to deal with local analog constraints on a worldwide scale, regional enterprises may be able to localize the digital platform business model, which can lead to the creation of sizeable markets. This implies, however, that regional digital platforms are inherently constrained to adopting asset-heavier business models (e.g. using kiosks in the case of mobile finance providers such as M-Pesa or Nigeria's Paga) and to slower scaling across more fragmented markets.

Due to self-sustaining growth and lock-in effects in digital product categories, such as digital payments, online search and operating systems, head-on competition and catching up by developing-country platforms is expected to become harder over time as platform markets become oligopolies or monopolies, leading to a widening of the digital gap This may be particularly true for innovation platforms, where the potential for combinatorial innovation and generativity scaling depends on standardization, interoperability and the mobilization of developer contributions across the widest geographical expanse possible. Becoming an innovation platform has so far proved elusive for

digital enterprises in developing countries. Instead, their best opportunities lie in focusing on those product categories where they enjoy a competitive advantage and protections from global incumbents in domestic and international markets.

An additional concern from a long-term development perspective is the risk that, once successful digital platforms in many developing countries acquire a certain scale, they will become attractive acquisition targets for bigger players. For example, Lazada (South-East Asia) was acquired by Alibaba, Souq (West Asia) was acquired by Amazon, Flipkart (India) was acquired by Walmart and 99 (Brazil) was acquired by Didi Chuxing.

D. DIGITAL ENTREPRENEURSHIP

1. Entrepreneurial ecosystems

Innovation and entrepreneurship rarely take place in isolation; rather, they depend on the quality of the surrounding ecosystems. The notion of entrepreneurial ecosystems has gained currency in practice and policy circles (Alvedalen and Boschma, 2017; Stam, 2015). As entrepreneurship is inherently a social and actor-driven process involving organizations and groups of individuals (Obstfeld, 2017; Ruef, 2010), it offers the potential for value capture and economic development at or near the location of the enterprise (Carree and Thurik, 2003). An understanding of entrepreneurial ecosystems can help explain why some cities and regions generate more productive enterprises than others (Stam and Spigel, 2018). It builds on cluster and innovation systems literature (Malecki, 2018; UNCTAD, 2018a), but emphasizes place-bound entrepreneurial resources, defined as "resources specific to the entrepreneurship process… rather than other types of industrial benefits found in clusters that accrue to firms of all sizes and ages" (Spigel, 2017: 52). More advanced ecosystems enable actors to exchange, pass on, and enrich resources more effectively in a continual, interactive and geographically confined process (Mack and Mayer, 2016; Spigel and Harrison, 2018).

Although most studies of digital entrepreneurship have been focused on global digital platforms, the vast majority of digital enterprises remain small and local. This is especially true in developing countries. An entrepreneur seeking to start a technology venture in an LDC faces fundamentally different conditions compared to one in San Francisco, London or Berlin, as shown in UNCTAD's *Rapid eTrade Readiness Assessments* and various UNCTAD *Science, Technology and Innovation Policy Reviews*. In these countries, investment capital is scarcer, infrastructure is weaker, and access to skilled knowledge workers is limited. Moreover, they may command relatively high wages. Despite increasing availability of broadband Internet, affordability and reliability issues persist. Thus, the geographical context of digital enterprises' physical embodiment (e.g. entrepreneurs and their social circles, staff, offices and computers) influences their ability to grow and contribute to local economic development.

Using the entrepreneurial ecosystem as a conceptual lens applied to digital entrepreneurship, this section reviews contextual constraints in developing countries. Entrepreneurial knowledge, venture capital that supports start-ups, and flexible networks of highly skilled professionals tend to be particularly important for digital enterprises, and they are generally immobile and regionally specific. The following analysis seeks to identify ecosystem bottlenecks as a basis for considering what could be effective policy responses (discussed in chapter VI).[121]

2. Main ecosystem bottlenecks

a. Small and fragmented local markets

A common bottleneck for digital enterprises in developing countries is the small size and scope of their markets. It is rare for them to be able to reach international markets. In the diverse sample used in one study on Africa (Friederici et al., forthcoming), 117 out of 135 enterprises (87 per cent) targeted their domestic markets. Enterprises typically focused on using digital technologies to cater to a nearby niche market. Generally, only software outsourcing providers were able to serve customers in high-income countries. African outsourcing is generally much smaller and less efficient than it is in South Asia, for example (Mann et al., 2014).

Indeed, few African digital enterprises reach customers beyond the boundaries of their home city. This is because they have to engage with customers directly, and also because only customers in cities have the minimum necessary infrastructural access or technological readiness to engage with a variety of digital products. As a result, only WhatsApp, Facebook

and applications provided by telecom operators, have achieved substantial reach across national markets (Chen et al. 2017; Stork et al., 2017), while local start-ups in Africa have seldom achieved such reach.

Ultimately, the markets that local digital enterprises have effectively been able to reach are much smaller than what statistics on smartphone and Internet adoption might suggest. Combined with end users' low willingness – or ability – to pay and their limited value to advertisers, digital products catering to consumers often struggle to become financially sustainable. In Africa, only in selected large cities, such as Nairobi, Lagos and Cape Town, are there large enough markets to deliver significant demand-side economies of scale.

b. Inadequate entrepreneurial knowledge and skills

Digital entrepreneurship is fundamentally skills- and knowledge-intensive. While policy tends to focus on technical skills taught at universities, entrepreneurial knowledge is at least as important, but it is often relatively weak (Spigel and Harrison, 2018). It involves knowledge of how to run and scale a digital enterprise, and is mostly tacit knowledge that is inherently situational; it cannot easily be imported from outside, and it is hard to codify or generalize. Instead, locally specific entrepreneurial knowledge is acquired through first-hand experience or through one-on-one, regular mentorship. In other words, one or two generations of digital entrepreneurs would need to have existed in a given place before relevant entrepreneurial knowledge can be diffused effectively and widely.

Digital entrepreneurship is still a rather novel practice. Even counting pre-broadband digital firms (such as bulk SMS providers), the oldest local firms were typically established in the early 2000s. A greater diversity of business models only began to emerge after the arrival of broadband around 2010, which means that entrepreneurial knowledge in most strategies is only just being developed.

Especially for the most resource-starved and nascent entrepreneurial environments, ecosystem development is often hampered by vicious cycles: the absence of experienced entrepreneurs who could function as legitimate visionaries and pass on their knowledge limits the prospects for newcomer enterprises. Entrepreneurs who have exited their first or second start-up function are often the most important resources for newcomers (Spigel and Harrison, 2018). In nascent entrepreneurial ecosystems, due to the absence or low numbers of such entrepreneurs, it may take a very long time before entrepreneurial knowledge begins to circulate.

c. Lack of a highly skilled and affordable workforce

Digital enterprises rely on creative, skilled staff, such as software developers, designers and data scientists, resulting in the emergence of a new class of professionals (see, for example, Avle, 2014; Avle and Lindtner, 2016). Yet a major problem for local digital enterprises is to be able to recruit and retain talent that is locally available. The dynamic working environment in a start-up often calls for different soft skills than local university graduates can offer, such as creative skills and critical and independent thinking (UNCTAD, 2017a). Local software developers may also lack knowledge of the more recent technical specializations, such as in server administration or algorithmic computing. Software engineers with exposure to clients in high-income countries, either through stays abroad or online freelancing, can become the most valuable team members in digital enterprises. However, such talent is also often expensive by local standards, even though their salaries tend to be lower than what these knowledge workers could earn in more advanced countries.

d. Limited access to finance

Access to finance is another critical determinant. In developing countries, and particularly in the less-developed ones, the financial sector is generally underdeveloped. Commercial banks are unlikely to provide the necessary funds to digital start-ups, given the high risks involved. Moreover, in most cases the start-ups lack the assets that may serve as collateral. This makes it important to look for other types of financing mechanisms, such as angel investors and venture capital. In addition, governments can help improve the situation by offering programmes and instruments for financing innovative activities in the early stages.[122]

In this context, the increasing formalization of angel investor networks and the emergence of venture capital funds with deep knowledge of African markets has made a marked difference in recent years. Examples include the African Business Angel Network (ABAN), which is combining entrepreneurial knowledge with carefully targeted funds through networking

and sometimes the pooling of capital. Vehicles such as TLCom's TIDE fund[123] and Chanzo Capital[124] are coupling financial resources from institutional investors, such as the European Investment Bank, with wide and deep networks, and experience and knowledge about typical challenges and opportunities in African markets.

In Latin America, as in Africa, access to funds for digital entrepreneurship is more limited than in other regions, particularly in the developed world. However, venture capital flowing to Latin America doubled in 2018, possibly signalling better prospects for digital entrepreneurship in this region.[125]

3. Innovation hubs: Opportunities and challenges

Innovation hubs can be understood as the organization-level equivalent of entrepreneurial ecosystems. In hubs, entrepreneurial networks and resources are anchored and assembled around a physically embodied focal organization (Capdevila, 2013; Schmidt and Brinks, 2017; Toivonen and Friederici, 2015). They are one example of a broader set of entrepreneurship support organizations that are more networked, bottom-up and community-oriented than traditional business incubators. These include coworking spaces, open creative labs, open innovation labs, maker spaces, and digital fabrication labs or FabLabs (Gryszkiewicz et el., 2017; Merkel, 2015; Seo-Zindy and Heeks, 2017).[126]

Many development organizations have considered innovation hubs as a support channel for boosting entrepreneurship. However, recent empirical studies suggest that, particularly for Africa, results, so far, have not lived up to expectations (Friederici, 2017; Jiménez and Zheng, 2017; Marchant, 2018). This is especially true with regard to the role of hubs as seamless network infrastructures for entrepreneurial ecosystems that allow entrepreneurs to thrive by giving them access to mentors, investors, staff, government, international corporations and others.

In Africa, only some hubs have become "buzzing" places, brimming with entrepreneurial activity (e.g. BongoHive in Zambia, described in Box V.2). Aspirational principles such as diversity and openness have often been contested and conflicted in day-to-day operations. In particular, exclusion effects in hub communities may arise from symbolic boundaries: some participating groups self-select into and out of hubs depending on whether they feel welcome, and whether they identify with those who are already there. A challenge is to balance homogeneity (social cohesion) and heterogeneity (e.g. diversity of competences, resources, knowledge) in different dimensions.

A common pitfall is that hubs provide merely a loose framework within which local entrepreneurs have to work, and they inherently depend on entrepreneurial engagement. However, entrepreneurial participation is neither predictable nor consistent; it varies over time and relies on attributes such as seniority and the culture of the hub. Further, if some entrepreneurs are committed, other entrepreneurs will benefit more from participating, and vice versa. In the case of kLab, a government-supported hub in Rwanda, the nurturing of a small community was found to be conducive to peer mentorship but achieved only limited reach. On the other hand, when kLab lowered its entry criteria, the space became popular with novices, but also overcrowded and impersonal (Friederici, 2018a). Thus, there are context-specific path dependencies and feedback loops: if motivated and capable entrepreneurs are hard to attract, it is harder to generate value for other locals. This creates challenges, especially in cities where ecosystems are fragmented and/or where no critical mass of capable digital entrepreneurs has emerged.

It may therefore be pertinent to consider hubs as assemblers of local entrepreneurial communities within entrepreneurial ecosystems. By convening, interconnecting and motivating entrepreneurs, they can help to transform social structures in a given ecosystem. Hubs can also serve as focal points within wider social, technological, or knowledge networks, but this is not a seamless process; the specific social dynamics and tradeoffs within a local community space greatly affect a hub's effectiveness (Littlewood and Kiyumbu, 2018; Marchant, 2018). The most effective hubs tend to have both a strong, active, self-determined community of entrepreneurs and a wide network of partners (e.g. corporations, governments and donors). Hubs are thus a managed and purpose-driven channel for the sharing of entrepreneurial resources, rather than their immediate creators (Spigel and Harrison, 2018).

Against this background, it is not surprising that the emphasis in support to African entrepreneurship has shifted to more direct interventions, supplying promising start-ups with capital and networks. For example:

Box V.2. BongoHive: From a community of enthusiasts to a leading innovation hub

BongoHive in Lusaka, Zambia, is one of Africa's leading innovation and technology hubs. It supports aspiring entrepreneurs to build growth-oriented businesses by addressing challenges and opportunities. Since its launch in 2011, it has evolved from being a meeting place for software developers to a support organization that assists entrepreneurs to validate their ideas, start a business, accelerate growth and attract investment.

Initially, BongoHive was created by a community of enthusiasts who would meet to exchange knowledge on emerging technologies (such as the Android platform) and good practices, as there was a wide disconnect between the knowledge that graduates gained in college and the requirements of industry. This was a major hindrance for new entrants into the Zambian technology industry, exacerbated by a lack of coordination, skills exposure and productivity in industry.

The hub organized its first workshop in Zambia for potential mobile app developers. Next, it started to reach out beyond tech-focused platforms to local creative and business communities. It hosted regular gatherings, hackathons, a "Mobile Monday" chapter, Meet the Industry gatherings and fireside chats with seasoned entrepreneurs. These different events allowed it to acquire knowledge about various sectors and help entrepreneurs identify opportunities for the use of technology to address different business challenges. It also provided assistance to the Asikana Network, a movement led by women to support women with careers in tech.

In 2016, BongoHive introduced new programmes for starting and building businesses, with support from Comic Relief of the United Kingdom under their Queens Young Leadership programme. Several successful start-ups have since benefited from BongoHive's activities. For example, Z'Pos' solution helps small business owners make better decisions through their point-of-sale systems; and Musanga, which was initially a food delivery service start-up, has become a delivery platform that helps manufacturers and retailers connect with independent transport providers for deliveries. Over the past three years, start-ups at BongoHive have raised some $750,000.

Looking ahead, BongoHive plans to introduce a growth incubator programme called Thrive. It will help entrepreneurs access technical advisory services, infrastructure and shared business support services, such as accounting and human resources. In addition, it established BongoHive Ventures, seed-funding that responds to the capital needs of start-ups with growth potential. Other plans include an investor-readiness programme that offers advice to start-up founders about the key areas considered influencing investors' investment decisions.

Skills gaps remain a problem. While universities and colleges play a critical role in imparting technical skills, graduates also need skills in solution design, critical thinking and teamwork. Commencing initially in five universities, BongoHive is helping tertiary-level students acquire the kinds of complementary skills that could help them start their own ventures or contribute to the growth of start-ups. Meanwhile, BongoHive X is another programme that aims to impart skills to tertiary-level students to provide innovative solutions to various challenges in society.

The hub has also worked with micro and small enterprises across Zambia. In partnership with the UKAID's Private Enterprise Programme Zambia, it designed and delivered short master's-level classes in digital marketing, market research, business accounting and public speaking to more than 300 people who owned or worked for micro or small enterprises.

Over the past three years, by leveraging digital technologies, businesses have emerged in a wide range of sectors, including fashion, agriculture, aquaculture, technology, personal development, professional services, delivery, and events management. In 2018, the World Bank accorded BongoHive the opportunity to support entrepreneurs involved in agro-processing through a project called the Zambia AgriBusiness BootCamp.

BongoHive is also a member of the Southern Africa Venture Partnership, a collective of hubs, including mHub of Malawi and TechVillage of Zimbabwe, which supports start-ups in the region. Along with fellow members of this Partnership, BongoHive recently joined Village Capitals' Africa Communities Program to implement their investor readiness programme in Southern Africa.

Source: UNCTAD, based on information from BongoHive, January 2019.

- The German Corporation for International Cooperation's Make-IT in Africa project has provided direct support through a comprehensive and multi-faceted programme for growth ventures.[127]
- The GSMA Innovation Fund has provided mentors and between $1 million and $2.3 million for African digital enterprises;[128]
- The World Bank's XL Africa initiative convened 20 ventures and linked them to investors (Kapil et al., 2018); and
- Google's accelerator in Nigeria provided start-ups with $3 million in funding and in-kind contributions.[129]

These initiatives focus on growth-oriented start-ups that already have some traction and proven teams, rather than on inexperienced junior entrepreneurs and software developers, unlike earlier hackathons and incentive measures such as innovation prizes.

It is practically impossible to evaluate the impact of such initiatives in terms of their "value for money". Hubs, accelerators, innovation prizes, and all other support mechanisms are dependent on pre-existing resources available in a given entrepreneurial ecosystem. For instance, local mentors are essential contributors to most kinds of interventions, but if they are absent in a nascent ecosystem, any supporting intervention becomes less effective. Isolated interventions (e.g. hubs or accelerators) will seldom achieve good results, given the complex context-specific interdependencies in ecosystems. Importantly, the presence of some successful digital enterprises can lead to positive feedback loops over time, while supporting entities, such as hubs, or even policymakers, are unlikely to infuse key entrepreneurial resources themselves. Thus, the above-mentioned ecosystem bottlenecks (including poor market access and entrepreneurial knowledge) should be considered in a holistic manner, and with a long-term perspective. Simply setting up supply-side interventions, such as hubs and tech parks, will not strengthen an ecosystem if other bottlenecks remain unaddressed.[130]

4. Unevenness and vicious cycles in ecosystem development

Vibrant ecosystems of digital entrepreneurship have emerged in some African cities. Every major African city now hosts at least a nascent, small-scale ecosystem, and hubs now exist in nearly every African country (Bayen and Giuliani, 2018; Firestone and Kelly, 2016). Young graduates are inspired by the possibilities opened up to them by digital entrepreneurship, and small local markets for customized software, app development and online freelancing have emerged.

However, progress in Africa has been uneven. Significant digital entrepreneurship activity began earlier in Accra, Cape Town, Nairobi and Lagos than, for instance, in Kigali or Addis Ababa. More and more diverse enterprises exist in those first four cities than in second-tier cities, and the density of innovation hubs and other support initiatives is also higher there (Bayen and Giuliani, 2018; Firestone and Kelly, 2016). Four countries (Egypt, Kenya, Nigeria and South Africa,) account for about 60 per cent of Africa's total digital entrepreneurship activity; six second-tier countries (Ghana, Morocco, Senegal, Tunisia, Uganda and the United Republic of Tanzania) make up another 20 per cent, while the remaining 44 countries in Africa account for the remaining 20 per cent (Friederici et al., forthcoming).[131] However, Africa still has fewer capital and other entrepreneurial resources than any other regions in the world (see, for instance, Startup Genome, 2017).

There appear to be strong vicious and virtuous cycles between different entrepreneurial resources that are "recycled" over time (Spigel and Harrison, 2018). Since such resources work in conjunction to support productive, growth-oriented entrepreneurship, the absence of foundational resources can block ecosystem development even if other resources are present. For example, constraints on the ability of start-ups to scale are influenced by the paucity of local talent, angel investors, a local customer base, venture-friendly legislation and support interventions.

Sequential patterns in ecosystem resource dynamics can also be observed. The creation of support organizations cannot compensate for shortages of entrepreneurial knowledge in the early stages of ecosystem development. In nascent ecosystems, interventions often focus on light-touch networking events and short-term training programmes. While these may infuse momentary inspiration and activity, they cannot replace the hard and slow work of localized experiential entrepreneurial learning. Small loans given directly to entrepreneurs may ultimately be a more effective and a necessary complementary means of support (McKenzie, 2015), even if pay-offs take longer to materialize.

A similar vicious cycle applies to investments. Investors are often hesitant or absent because investable start-ups are rare in ecosystems with fragmented and small local markets. This, in turn, limits the growth and exit possibilities for the few promising local start-ups that do exist. Networking organizations (such as innovation hubs) are not always able to entice experienced entrepreneurs to participate in their activities, either because the latter may still be preoccupied with building their own start-ups or because they are sceptical about hubs. Many types of entrepreneurial resources can only be fully effective in the later stages of ecosystem development, once basic resources such as entrepreneurial knowledge and risk capital have become available.

Latin America and Asia present more dynamic entrepreneurship and innovation ecosystems than those found in Africa. Although countries in these regions also present weaknesses in terms of finance, skills or connectivity, in most cases these limitations may be less constraining. In Asia, trends vary depending on the level of development. China and India are leading in the creation of start-ups, accounting for 58 per cent of the total for the region. The dynamic ecosystems of South-East Asia represent 13 per cent, with Indonesia, Singapore and Viet Nam accounting for 80 per cent of the start-ups in this subregion. The more advanced economies, including Japan, the Republic of Korea and Taiwan Province of China, account for 10 per cent of the start-ups in Asia. The less developed countries in the region, whose experiences and characteristics are closer to those of African countries make up the remaining 18 per cent (AFD, 2017).

In Latin America, start-ups have sprung up mainly in a few urban centres: Buenos Aires, Bogota, Mexico City, Lima, Santiago and Sao Paulo. Since 2010, their promotion has become a priority in national innovation and development strategies in the region. Examples include: Start up Chile, iNNpulsa Colombia, Start up Peru, Start up Brazil and Incubar Argentina. This has been accompanied by an increasing number of accelerators (AFD, 2017).

E. STRATEGIES FOR DIGITAL ENTERPRISES IN AFRICA

As discussed above, most digital enterprises in Africa are operating under challenging conditions. First, they face insurmountable international competition in the most scalable product categories. Second, they are forced to find solutions to local challenges relating to both digital and physical infrastructure. Third, they have limited access to place-bound entrepreneurial resources such as capital and talent. This section draws on recent empirical research involving interviews with African entrepreneurs to gain a better understanding of how the particular local contexts in a number of African cities are influencing their strategies (Friederici et al., forthcoming). What emerges is that, digital enterprises in Africa are currently adopting one of three strategies to become sustainable as discussed below.

1. Old-school sustainability: Customer relationship scaling as a viable alternative

The first strategy involves customer-relationship scaling adapted to local niche markets. Digital enterprises can benefit from some economies of scale in code and content creation (e.g. near-zero cost of the second copy, using digital building blocks), but they establish and maintain one-to-one customer relationships through direct and regular interactions. Due to high marginal costs for each new customer, this strategy is most common in business-to-business sectors, such as customized software development for local firms, enterprise resource planning (ERP) systems, supply chain management systems and business analytics services. Examples of successes include Torque, Data Systems and Evolve (Rwanda), Delivery Science (Nigeria), Uhasibu and Microclinic Technologies (Kenya), and 50lomi (Ethiopia). While these enterprises usually remain rather small, those that consistently deliver high quality services, and therefore benefit from customer referrals, can expand to tens or hundreds of employees, such as Craft Silicon (Kenya) and C-Net (Ethiopia).

This strategy has suited many African digital enterprises, for three reasons. First, it does not require major upfront investment before revenue is generated. This is important for entrepreneurs that lack sufficient savings or access to risk capital. Second, digital enterprises are able to learn from customers iteratively, continuously adapting products and conducting maintenance in response to direct requests for improvements. Third, international competitors may offer higher quality solutions in the same product category (e.g. SAP software for ERP), but their offerings may be unnecessarily complex, poorly aligned with local requirements (such as particular accounting norms), or too expensive.

2. Last-mile platforms: Moderate user-base scaling through digital-analog infrastructures

The second strategy also targets local markets, but is oriented towards larger groups of end users (consumers or small businesses). It may involve user-base scaling, but complements digital infrastructures with analog outposts to improve customer engagement. This strategy basically takes a lesson from M-Pesa's successful use of an elaborate agent system.[132] Enterprises use agents and regular workshops and training sessions to attract and interact with customers. Examples of companies that have adopted this strategy include AgroCenta, meQasa and Abossey Okai Online (Ghana), Paga (Nigeria), and SafeMotos and Ared (Rwanda).

This strategy seems to work in African markets because it directly addresses two demand-side constraints, namely: (i) low trust and capacity in the use of digital technology, and (ii) infrastructure weaknesses (e.g. no – or low – Internet bandwidth or outdated devices). These companies are all transaction platforms with important offline complements to the online services – a major difference compared with their global counterparts (such as Uber, AirBnB or Amazon). To remain physical-asset-light, such global platforms explicitly rely on other platform users for offline customer interactions, while the platforms themselves engage with customers only through software and apps. The global platforms count on customers' preference for digitally mediated interactions (e.g. considering online shopping to be more convenient than going to a physical store). By contrast, African platforms deliberately engage in offline interactions with end users. This has been referred to as "last mile platforms".

3. Using exclusive local assets to derive value for clients in developed countries

A third, less common strategy is to exploit the distance-bridging potential of digital technologies to reach customers in developed countries, while turning a physical presence in Africa into an asset. This may involve new adaptations of software development outsourcing, as in the cases of Andela (with offices in New York, Lagos and Nairobi) and Gebeya (with offices in London, Ethiopia and Nairobi). Both companies take advantage of the incessant demand for software developers in developed countries and the low cost of labour in Africa. However, they are also setting up local African operations that are more elaborate than call centres to ultimately nurture African developer talent as a unique asset (Box V.3).

In each of the three strategies, the digital enterprises blend digital technologies with analog assets with a view to turning a formerly locational deficit into a competitive advantage, a valuable asset or a source of innovation. However, each strategy requires further local modifications and adaptations to become viable.

Box V.3. The strategies of Andela and Gebeya

Andela uses a hands-on educational model, including large-scale physical campuses, to train young software developers to a point where they can independently complete projects for clients in the United States. Unlike many traditional outsourcing companies, it acknowledges that experiential learning and craft knowledge required for advanced software development cannot be mass produced or taught entirely online. Accordingly, it emphasizes organizational culture, invests in brand building, and gives bright young coders full stipends, hoping to thereby gain buy-in by both United States-based customers and African developers. Andela has been able to mobilize significant risk capital to build analog structures on an efficient scale.

Gebeya adopts a marketplace (i.e. transaction platform) model, where African software developers are matched to suitable jobs from clients. The company uses its location in proximity to Ethiopia's vast digital labour market, local knowledge and its founder's continent-wide networks to achieve efficient scale and assure quality. This strategy reaches beyond outsourcing, to productize local knowledge that is valuable to clients in high-income countries. For instance, an agricultural digital innovation provider placed a permanent representative in Geneva, Switzerland, functioning as a local market knowledge broker along global food supply chains. Similarly, an analytics provider in Accra markets databases offering business information to investment firms in more advanced economies.

Source: UNCTAD.

Capable entrepreneurs creatively adjust to market signals by iteratively improving their products (Alvarez et al., 2012). These signals can inform African digital entrepreneurs to localize their activity one way or another. Customer relationship scalers conduct demand-driven localization for business customers. Last-mile platforms conduct demand-driven localization for consumers or large groups of small business users. The local asset strategy caters to commoditized international demand while deriving value from a localized process of code and content creation. Such localization may set African digital enterprises onto slower growth paths than global platforms, but, given their geographical starting point, such a strategy may be the best way to create and capture value through digital technologies within Africa.

However, almost no African digital enterprises are creating digital infrastructure that is in wide use and becomes embedded. While software production for business customers and users is common, the enterprises seldom, if ever, create digital building blocks for innovators elsewhere in Africa or beyond. While the international expansion of some payment services (such as Paga and M-Pesa) and integrative platforms (such as Flutterwave) is encouraging, greater homogenization and integration of digital infrastructure are needed across African and other developing countries to set them on regionally suitable digital innovation paths.

F. DIGITALIZATION OF ENTERPRISES IN DEVELOPING COUNTRIES

In most developing countries, whereas digital entrepreneurship focuses especially on opportunities in the digital sector itself, there could be considerable scope for reaping the benefits from digitalization in other parts of the economy. For example, in many countries, the number of ICT specialists is at least as high in industries outside the core ICT sector (chapter III). Moreover, when existing firms in traditional sectors digitalize to optimize their production and management processes, significant productivity gains have been observed. One study estimates that as much as 75 per cent of the economic impact of the Internet in 12 large developing and developed countries originates in firms in traditional sectors (Manyika et al., 2011).[133]

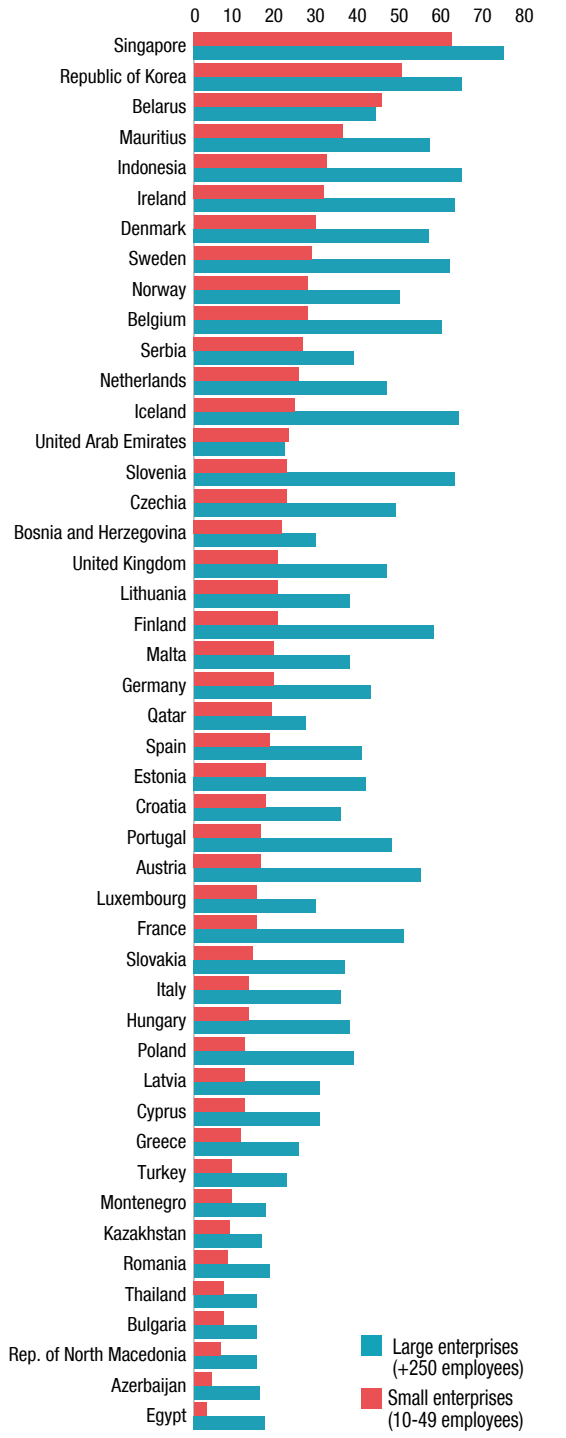
At the same time, there is evidence to suggest that the extent of benefits from digitalization depends on pre-existing economic and social structures, and on critical mass effects. As a result, higher income countries tend to benefit more than countries at lower levels of income (Albiman and Sulong, 2017; Galperin and Fernanda Viecens, 2017).

Digitalization and the rise of the platform economy are greatly transforming the way firms connect to others, be they buyers, suppliers, peers or supporting institutions at home and abroad. This is entirely reshaping the business ecosystem of MSMEs. MSMEs in developing economies, and especially in LDCs, will need affordable access to appropriate ICT infrastructures to be able to compete effectively in the digital economy. These include mobile telephony, as a minimum, but increasingly also broadband connectivity, which should be extended also to rural areas at affordable rates of access. In addition, MSMEs need assistance to make more effective use of ICTs.

Most micro and small firms generally lag far behind large ones in ICT use (figure V.2). This constitutes a significant barrier to their effective integration into GVCs that are becoming increasingly reliant on digital solutions (UNCTAD, 2017a). In both developing and developed countries for which data were available, it is observed that a lower proportion of small enterprises make use of the Internet than large companies. Moreover, fewer enterprises generally engage in complex tasks online. For example, enterprises are more likely to use the Internet to obtain information about goods and services than to deliver products online, which requires adapting their business model to the online world. In countries where ICTs are widely available, the proportion of enterprises that are performing more complex online tasks tends to be higher.

The nature and extent of platformization will also have different impacts on MSMEs in developing countries (UNCTAD, 2017a). Slow progress towards more sophisticated use of digital technologies may reflect lack of skills, motivation, resources and appropriate systems. For example, in the tourism industries of some developing economies, skills gaps limit the extent to which small hotels are able to technically link into global systems, even if they have good connectivity.[134] In agriculture, the use of online platforms may be feasible only if firms can obtain complementary support in the form of capacity-building, training or other technical assistance that can enable them to obtain finance or meet quality standards.

Figure V.2. Proportion of small and large enterprises receiving orders over the Internet, selected countries, 2018
(Per cent)



Source: UNCTADstat.

Note: Data for Rep. of North Macedonia and Egypt refer to 2016; data for Singapore, Belarus, Indonesia, United Arab Emirates, Qatar and Azerbaijan refer to 2015; data for Republic of Korea, Kazakhstan and Thailand refer to 2014; and data for Mauritius refer to 2013.

In buyer-driven GVCs controlled by a few lead firms, such as in garments and agricultural commodities, various forms of more open online platforms allow sellers from lower income developing countries to reach buyers. Examples include the use of agricultural price platforms by exporters in Africa, and the use of e-commerce platforms by agricultural firms. However, where large buyers are dominant, they are likely to exercise control over access to markets and to their trusted brands, in which case the transformational impact of digital platforms will be limited.

Platforms are probably the most useful for MSMEs in markets characterized by a diversity of buyers rather than by the dominance of a single market or set of firms. They also offer scope for functional upgrading in value chains where producers build trust and potentially move to sell higher value-added exports. For instance, some developing-country producers have been able to use platforms to upgrade from commodities to beer-making, or from basic goods to food products that could be regionally exported (Hinson, 2010; Tiamiyu et al., 2012).

In general, participation in online platforms may be more useful for smaller firms that compete in specific, well-defined market segments, such as trading in a niche tourism market and in value-added food products (e.g. ethical goods) as well as in regional and emerging market value chains. While such segments and markets may seem relatively small, these kinds of online platforms can help producers reach more clients and achieve sufficient economies of scale and income generation (UNCTAD, 2017a).

In conclusion, it is important to strengthen the capabilities of MSMEs in developing countries to engage in and take advantage of the digital economy. The scope for value creation and capture in an economy is significantly enhanced if the domestic firms – not only those in the digital sector itself – have the resources, skills and awareness needed to transform digital opportunities into greater competitiveness. Moreover, the stronger the absorptive capacity of MSMEs throughout an economy, the greater are the chances of positive spillovers from the introduction and adoption of digital technologies. Overall, in the short term, it is likely that, given the production structure in developing countries that have a higher weight of agriculture and services, it is the enterprises in these sectors that will realize most of the gains from digitalization.

G. CONCLUSIONS

This chapter has shown that, despite global inequalities in the digital economy, there are opportunities for enterprises in developing countries to benefit from digitalization. Such opportunities may emerge from using global digital platforms in productive ways, developing local or regional platforms, as well as promoting digital entrepreneurship and the digitalization of existing companies, especially MSMEs. However, developing countries face significant obstacles to reaping the gains from the digital economy, particularly the countries trailing the furthest behind in this evolving landscape.

Opportunities from the digital economy are constrained in many ways. Some of them are linked to deficiencies in local infrastructure and entrepreneurial ecosystems, while others are due to the way in which the digital economy is unfolding. Against this background, digital business models often have to be adapted from those applied in the more advanced economies, taking into account local circumstances and limitations. Entrepreneurs and policymakers can learn from some of the positive experiences outlined in this chapter. At the same time, the significant obstacles facing digital entrepreneurs and MSMEs that prevent them from taking advantage of the digital economy should be fully recognized when assessing development potential in most developing countries.

It is clear that inclusive development gains from the digital economy will not be realized automatically from simply expanding access to affordable broadband connectivity. In the current context, government interventions in a number of policy areas relating to digitalization will be needed to secure outcomes that can support efforts to achieve the SDGs. That is the focus of the next chapter.

Notes

[114] This discussion about first and second order benefits is based on Arbache, 2018.

[115] Research and analyses on digital entrepreneurship and innovation in developing countries are still sparse. This chapter draws heavily on work undertaken at the Oxford Internet Institute on digital entrepreneurship in Africa (Friederici et al., forthcoming).

[116] There is a general scarcity of empirical evidence from developing countries in this area. The most comprehensive reviews at the global level are those of the Center for Global Enterprise survey (David-West and Evans, 2015; Evans, 2016; and Evans and Gawer, 2016). While there may have been changes in this landscape since they were completed, the studies remain a valid source for a comprehensive assessment of digital platforms in developing countries. This section relies mainly on these surveys, as well as on insights from interview-based empirical research on digital entrepreneurship in Africa (Friederici and Graham, 2018; Friederici et al., forthcoming).

[117] These findings are in line with the non-representative but indicative sample analysed by Friederici et al. (forthcoming): only 2 out of 135 enterprises – Flutterwave in Lagos (http://flutterwave.com/int/developers/) and Hubtel in Ghana (https://developers.hubtel.com/) – can be considered innovation platforms. While Flutterwave has had significant success in attracting investments (Flutterwave, 2018), it is too early to assess their performance.

[118] This is based reviewing a database of 277 online digital platforms in eight African countries, available at: http://access.i2ifacility.org/Digital_platforms/.

[119] See *Tech Crunch*, 12 April 2019, African e-commerce startup Jumia's shares open at $14.50 in NYSE IPO.

[120] *Contxto*, 16 April 2019, The 19 Latin American unicorns galloping to success.

[121] This section draws on empirical research on digital entrepreneurship in Africa (Friederici et al., forthcoming), and highlights aspects that are likely to be relevant in other developing countries as well (Boateng et al. 2017; Ndemo and Weiss, 2017; Quinones et al., 2017; Ravishankar, 2018).

[122] For more detailed discussions on the financing of innovation and entrepreneurship, see UNCTAD, 2018a and 2019c.

[123] See: www.tlcomcapital.com/about-us/tide_africa_fund/.

[124] See: http://www.chanzocapital.com/.

[125] See *Medium*, 15 March 2019, Tectonic shift in Latin American venture capital explained.

[126] For simplicity, all these organizations are referred to as "hubs" in this chapter.

[127] See: https://make-it-initiative.org/africa/.

[128] See *Disrupt Africa*, 28 April 2017, Africa dominates GSMA Innovation Fund grant winners.

[129] See *Disrupt Africa,* 19 March 2018, 12 startups selected for first African Google Launchpad Accelerator.

[130] This discussion on innovation hubs was drawn mainly from Friederici, 2014, 2017, 2018a and b.

[131] This highly skewed distribution is similar to other observations on risk investments and valuations, and the unevenness appears to be increasing over time (Collon, 2017 and 2018; David-West and Evans, 2015*; Disrupt Africa*, 2016, 2017 and 2018; VC4Africa, 2014, 2016, 2017 and 2018).

[132] M-Pesa probably would not have been able to scale its user base beyond a critical mass without setting up agents across Kenya, who functioned as a physical interface to digitize information (e.g. cash turned into digital credit), while also creating trust among users and offering them convenience.

[133] Other studies confirm that the bulk of the productivity growth in the United States has originated in ICT-using rather than in ICT-producing sectors (Jorgenson, 2001 and 2011).

[134] See also UNCTAD, 2017d.

Previous chapters have demonstrated some of the major transformations caused by the digital economy, and especially the growing reliance on digital data. These transformations are facilitating the creation and expansion of new business models and ways of organizing production. At the same time, the high levels of concentration of resources, skills and capacities needed to leverage digital transformations are heightening the risk that further digitalization and data-driven development will lead to widening digital divides and income inequalities, instead of contributing towards more inclusive and sustainable development.

Technology is not deterministic; it can create both opportunities and challenges. It is up to governments, in close dialogue with other stakeholders, to "shape the digital economy" by defining the rules of the game. This in turn requires a reasonable sense of the kind of digital future that is desirable. Policymakers, the private sector and civil society need to get together to make choices that can harness the potential of the digital economy to spread its benefits more equitably and empower people to combat rising inequalities.

POLICIES AIMED AT VALUE CREATION AND CAPTURE

POLICIES TO FACILITATE VALUE CREATION AND CAPTURE

New policies at national and international levels needed to build an inclusive digital economy

Technology is not **deterministic.**
It creates both:

opportunities

challenges

Policy makers need to make choices that can help reverse...

...the trends towards widening **inequalities** and **power imbalances**

The **global nature of the digital economy** will require more:

consensus-building

dialogue

at the international level

policy making

It is up to **governments**

in close **dialogue**

with other **stakeholders**

- Academia
- Private sector
- Civil Society
- Tech community

to shape the **digital economy**

by defining the **rules of the game**

Policy areas that need particular attention

Strengthening the readiness of developing countries to engage in and benefit from e-commerce and the digital economy

Digital entrepreneurship and innovation policies, leveraging niche areas and domestic opportunities, including for women

Data policies for capturing value

Digitalization of **MSMEs**

Competition policies for the digital era

Taxation of digital platforms

Labour market, skills and **social protection** policies

Intellectual property policies in the digital economy

Development cooperation with more attention to the digital dimension

Need for new policies and regulations tailored to national objectives backed by more international support

- Digital divides
- Differences in readiness
- High concentration of market power

Need for **new policies and regulations**

That can create a **a fairer distribution of gains**

- Need for **policy space** for **experimentation** to assess the benefits and disadvantages of different options
- National efforts in developing countries → **Inclusive digital transformation** ← More International support

A. INTRODUCTION

To secure a digital future for the many, rather than the few, domestic and international policies should go beyond simply enlisting more developing-country users and consumers into the digital economy; they should also enable the building of domestic capabilities to create and capture value. Only then can the process of digitalization fully support the Agenda 2030 for Sustainable Development. The challenge is huge, involving the adaptation and adoption of policies, laws and regulations in many areas. While some issues can be addressed through national policies, others necessitate collaboration and policy dialogue at regional and international levels.

This chapter explores options for governments to enable their countries to create and capture more value, as well as a more equitable distribution of the gains from the digital economy. The context is complex. On the one hand, the introduction of new technologies and their applications creates radically new opportunities for individuals to find information, resources and new jobs, as well as to offer their skills and services in global markets. For firms in the digital sector, enhanced use of ICTs and various digital applications may create more demand for both ICT goods and services. In digitally enabled sectors, firms may take advantage of e-commerce and other digital platforms to reach new clients, improve their productivity and develop new business models. In terms of economy-wide impacts, the successful leveraging of the digital economy may generate more economic growth, employment and taxable revenues (table II.2).

On the other hand, the potential benefits are far from automatic, and there are major challenges, costs and risks involved. To start with, countries are at different stages of preparedness to engage in and seize opportunities from digitalization and platformization. This calls for efforts to build the capacities needed to help more people and businesses in developing countries to become developers, producers and exporters in the digital economy. Secondly, there is a need to revisit national and international policies that can affect the creation and distribution of wealth. These include policies relating to data, competition, taxation, the labour market and intellectual property (IP), trade, as well as to development cooperation.

A particular complication is the rapid evolution of the digital economy, and the lack of reliable evidence as to which policies may or may not work in certain settings. Even the most advanced economies have only just started to assess how best to deal with digital disruption (OECD, 2019d). Many developing countries are at a further disadvantage due to the lack of reliable evidence and statistics in areas of direct relevance to the formulation and monitoring of policies for harnessing the benefits of digital transformations (chapter III).

This chapter is organized as follows. Section B considers the role of national policies in building an ecosystem that is conducive to digital entrepreneurship and value creation in the digital economy. It discusses ways to help countries that are trailing in digital readiness to improve their performance in key areas, drawing on recent UNCTAD work. Special attention is given to areas offering opportunities for domestic digital entrepreneurship and innovation linked to platformization, promoting the empowerment of women entrepreneurs and fostering the uptake of digital technologies by MSMEs.

Section C discusses different policy options for exploiting digital data for value creation and capture. Specific areas include data ownership, data protection and privacy, regulating cross-border data flows and skills development. Section D focuses on the possible need for adapting competition law and policy to developments in the digital economy. It discusses competition law enforcement, regulation and the need for international collaboration in these areas. Section E reviews recent policy trends related to digitalization and taxation, with a special emphasis on the role of digital platforms. Section F deals with the treatment of intellectual property in the digital economy. Section G examines the need for labour market and social protection policies. Section H considers the role of the international community and ways in which official development assistance could contribute towards securing a more inclusive outcome of the digital economy. Section I concludes.

B. NATIONAL POLICIES FOR CREATING AND CAPTURING VALUE IN THE DIGITAL ECONOMY

1. Connecting the dots in policy-making

Most developing countries face many constraints in trying to benefit from the digital economy. Governments and other stakeholders need a basic understanding of the dynamics of the digital economy before they can formulate and implement relevant policies. They can benefit from access to empirical evidence of their

own performance in policy areas that have a bearing on their ability to participate productively in the digital economy. In view of the cross-sectoral nature of digitalization, countries should adopt a coordinated response to the formulation and implementation of policies to secure benefits from digitalization.

Given that the rise of data-driven digital development is a recent phenomenon, there are few tried and tested approaches to consider. Even among the developed economies, digitalization presents many new challenges. As stated in a report presented at the OECD Going Digital Summit in March 2019 (OECD 2019d: 158):

> Digital transformation is complex and evolving rapidly. Policy decisions must increasingly be made under uncertainty about future digital and other developments…While progress has been made in answering some of the most pressing and difficult questions that governments face today, more work is needed to understand some complex issues and to design resilient policy frameworks in response.

For countries at lower levels of digital readiness, it is important to raise awareness and understanding of the key issues at stake. As policy priorities will differ among countries, due to their varying levels of development, there is no one-size-fits-all approach. Their policy approach needs to be holistic and multidisciplinary, and involve relevant stakeholders. This requires an effort by governments to create suitable mechanisms that enable the collection of relevant information for producing the intelligence needed to formulate and implement appropriate policies and strategies. Good practices in this context include the identification of high-level advocates in a lead ministry (as has been done, for example, in Kiribati, Togo and Vanuatu) who can create a dedicated cross-ministerial team to develop coherent policy responses. Another way is to follow the example of Uganda and form a national task force or committee on e-commerce with a lead agency, and assign responsibilities (UNCTAD, 2019b). Governments can also benefit from effective participation in policy dialogues at the regional and global levels (box VI.1).

2. Lessons from UNCTAD's Rapid eTrade Readiness Assessments of LDCs

Enhancing the e-commerce readiness of a country is important so that more firms and people are able to create value through the digital economy. Since 2016, UNCTAD has conducted *Rapid eTrade Readiness Assessments* in LDCs covering seven key policy areas to help them improve their e-commerce capabilities. By April 2019, 17 such assessments had been completed.[135] Each study provides an analysis of the current e-commerce situation in the assessed country, identifying opportunities and barriers that serve as a valuable input to these countries' involvement in discussions related to e-commerce and the digital economy. This section presents some of the key policy recommendations that have been derived from these assessments to support national policy-

Box VI.1. UNCTAD platforms for international policy dialogue on the digital economy and development

In the past few years, UNCTAD has developed several new platforms in support of cross-cutting and multi-stakeholder dialogue on how to secure sustainable development gains from digital transformations.

The UNCTAD eCommerce Week has become a well-attended forum to discuss the development challenges and opportunities created by the digital economy. The fifth such week was held in 2019, with more than 1,500 registered participants from some 135 countries, and representing all stakeholder groups.[a] In 2018, the *Africa E-commerce Week* was held in Nairobi in December, co-organized with the African Union and the European Union. It examined ways of enhancing the readiness of African countries to trade online and digitize their economies. It produced the *Nairobi Manifesto*, which provides policy recommendations in critical policy areas.[b]

Another important platform is the annual *Intergovernmental Group of Experts on E-commerce and the Digital Economy*. It was convened for the third time in April 2019 to discuss the role and value of data in e-commerce and the digital economy and its implications for inclusive trade and development.

Source: UNCTAD.

[a] See the Summary Report of eCommerce Week 2019 at: https://unctad.org/meetings/en/SessionalDocuments/dtl_eWeek2019_summary_en.pdf.

[b] See https://unctad.org/en/conferences/Africa-e-week2018/Pages/default.aspx.

making.[136] They can be considered low-hanging fruit to enhance LDCs' readiness to engage in and benefit from digitalization. More detailed information can be found in each of the assessments.

a. Strategy formulation

With a view to developing a unifying "whole-of-government" approach to harnessing the digital economy, it is advisable to improve inter-ministerial coordination with the appointment of a lead ministry. Countries generally also need to collect better statistics and information. Moreover, efforts to raise awareness among key stakeholders about the implications of e-commerce and other digital developments are important, as is the establishment of mechanisms for effective public-private dialogue. This would include soliciting views of enterprises of different sizes in different sectors. For example, countries like Bangladesh, Madagascar and the Solomon Islands, all engaged in effective public-private dialogues to collect relevant information from MSMEs during various stages of the assessment. In Myanmar, the Ministry of Commerce organized several consultations with relevant ministries and agencies to discuss and endorse recommendations of UNCTAD's *Rapid eTrade Readiness Assessment*. It also convened a donor round table to solicit support from development partners.

b. ICT infrastructure and services development

Affordable connectivity remains a major challenge in many LDCs, especially in their rural and remote areas. In order to accelerate access to adequate ICT services, efforts should be made to increase access to fast, affordable and reliable Internet services, as well as to last-mile connectivity. In this context, support should be given to public-private partnerships (PPPs) to strengthen national backbone infrastructure and improve access to international bandwidth. At the same time, governments should be aware of the various risks associated with PPP arrangements.[137] Clear targets for quality of telecom services should be set and enforced, and network performance obligations specified.

c. Trade logistics measures

In all the LDCs reviewed, it was found that inefficient trade procedures and logistics infrastructure limit their ability to take advantage of the digital economy. There is generally a huge need for improving physical infrastructures, and for modernizing the transport and logistics sector. There is also scope for streamlining customs procedures, particularly for cross-border shipments of small parcels. To facilitate domestic deliveries, physical addresses and postal code systems often have to be developed, including by leveraging innovative geospatial applications. Governments should also consider encouraging the use of new logistical solutions through partnerships with private courier companies, logistics providers and national postal services.

d. Payment solutions

In view of the high reliance on cash-based transactions in most LDCs (UNCTAD, 2015d), governments should consider promoting mobile payments and other cashless solutions, as well as digital financial literacy among MSMEs. They could also encourage the development of e-banking innovations, online inter-bank money transfers and online payments. The interoperability of different mobile money and e-payment platforms could be improved with a view to reducing friction in online transactions, increasing their ease-of-use for consumers, and reducing costs for merchants and platform operators. This often requires appropriate regulations to support more competition in the marketplace and foster innovation.

e. Legal and regulatory frameworks

Many LDCs lack appropriate legal and regulatory instruments to foster online transactions. A useful starting point is to perform a regulatory gap analysis, which would provide the basis for a holistic approach to formulating laws and regulations needed for e-commerce and the digital economy, and then adopt baseline e-commerce legislation or updating relevant laws and regulations in line with international best practices. Areas of particular relevance include legislation relating to e-transactions, consumer protection, data protection, intellectual property and cybercrime. The adoption of laws and regulations needs to be complemented by effective enforcement, as well as appropriate capacity-building among lawmakers and some members of the judiciary.

f. Skills development

There is a significant need to build relevant skills and other capabilities to enable active participation in the digital economy. Courses in tertiary education and vocational training dedicated to e-commerce are recommended to help close the gap between

the knowledge and skills of current graduates and the needs of an increasingly digitally enabled private sector. Business support organizations may need to refocus their services so as to tailor them to the requirements of the digital economy. Special attention should be given to women and girls to redress the current dominance of men in the ICT sector workforce and in ICT occupations (see also section VI.B.4).

g. Access to financing

Established lending practices tend to favour large firms in mature industries rather than MSMEs seeking to explore opportunities in the digital economy. Key recommendations include encouraging commercial banks to develop tailored lending practices and products better adapted to the needs of digital entrepreneurs. Special efforts may also be needed to train MSMEs in developing bankable business plans that meet the requirements of commercial banks. In order to help more women take advantage of business opportunities in the digital economy, governments should persuade business associations and women-led associations that work closely with small businesses to undertake capacity-building initiatives. In addition, entrepreneurs and MSMEs could be encouraged to look beyond traditional financial institutions and explore alternative funding models, such as innovation grants, loan guarantees, incubators and venture capital.[138]

3. Fostering digital entrepreneurship and innovation

In low-income developing economies, the extent and speed of the direct effects of improved access to the Internet and various digital technologies on local economic development have been limited so far (chapter V). Boosting entrepreneurship in the digital and digitally enabled sectors is important to facilitate more value creation in the digital economy. Due to low levels of e-trade readiness, entrepreneurs in the digital economy of many developing countries face various barriers to scaling their activities. Firstly, global digital competitors are already well-established in the most scalable digital product categories. Secondly, servicing local markets digitally may require setting up blended digital-analog processes to build up a user base or create a unique value proposition. In their absence, digital platforms in developing countries are often unable to become physical-asset-light, in the way as their counterparts in developed countries. They therefore need to apply different business models.

Digital entrepreneurship is a relatively new economic practice for which empirical evidence is generally scant. For government support of digital entrepreneurship to be effective, close dialogue is needed with relevant stakeholders. Meaningful dialogue and interactive learning happen mostly on a one-on-one basis or in small group discussions rather than in public venues. Large-scale "talk shop" conferences and meetings may serve to inspire discussion, but it is often more effective to assign a few outreach representatives to engage directly and continuously with local entrepreneurs. Policymakers should work with established hubs in making decisions on what sort of support they should provide to entrepreneurs. In the i4Policy initiative in Africa, for example, hub managers convene to establish a venue for policy dialogue.[139] They should also seek to integrate efforts to promote digital entrepreneurship into broader policies to promote innovation.[140]

Policymakers should target their actions and measures to the specific dynamics of local digital entrepreneurship. The traditional channels for supporting microenterprises (e.g. non-growth-oriented) and traditional SMEs (e.g. through loan programmes and trade shows) are unlikely to be very effective.[141] For instance, digital entrepreneurs may not have the required collateral, or may be too young to qualify, for traditional grants or loans. Furthermore, the needs of digital entrepreneurs vary across regions and countries, and also depend on the kind of venture and its stage of development. What is useful for a university graduate starting a digital business (e.g., meetups or hackathons) is of limited value to a more advanced start-up looking for legal advice, subject-matter expertise or international contacts.

Building an ecosystem conducive to digital entrepreneurship takes time. Many critical intangible resources (e.g. entrepreneurial knowledge, strong local networks and organizations, and cultural changes) can only materialize over time (Athreye, 2005; Storper et al., 2015). It may be preferable to adopt indirect, long-term-oriented and non-traditional approaches, which suggests the need for iterative policy experimentation and evaluation (UNCTAD, 2018g). The earlier this process begins, the better.

It is especially important to facilitate a long-term build-up of immobile, or "sticky", entrepreneurial

resources. Physical resources (e.g. broadband Internet, government-subsidized office space in hubs and incubators) and financial resources (e.g. grants, loans) are necessary but insufficient conditions for digital entrepreneurship to thrive. Investment in hubs, incubators and technology parks can be a waste of resources if they remain unused due to other bottlenecks, such as limited market access or weak entrepreneurial knowledge. The sheer number or size of such interventions thus remains a poor indicator of the quality of an entrepreneurial ecosystem. Moreover, the more control and influence that entrepreneurs themselves have over dedicated spaces and innovation facilities, the better. The case of BongoHive in Lusaka (box V.2) is a good illustration of how, when well implemented, innovation and technology hubs can make a positive difference.

More broadly, social and intangible factors (e.g. knowledge, networks and culture) are important but hard to influence. Physical and financial resources have to be designed and combined so that they reflect the realities of entrepreneurial processes. For instance, diligence and eligibility requirements for government grants should not result in the exclusion of start-ups in the informal sector. Tech parks sometimes remain empty and ineffective because they are located in places that are unattractive to entrepreneurs or difficult for them to access, or they are unable to assume an entrepreneurial culture (Lerner, 2009).[142] When faced with a choice, governments should consider focusing less on light-touch initiatives with promotional value (e.g. hackathons or bootcamps) or on high-profile infrastructure projects (e.g. tech parks), and more on efforts to foster tacit entrepreneurial knowledge creation through subsidized mentoring programmes, vocational training, apprenticeships and internships.

Market scale matters. For instance, some Chinese platform-based companies, adopting similar strategies to those of their peers in the United States, succeeded because they were enabled by early and long-term-oriented investments in local innovative capacities, and by a vast domestic market shielded from foreign competition. However, the Chinese experience is difficult to replicate by smaller developing economies with limited bargaining power. Market protection measures stand a better chance of generating desirable outcomes if there is a homogenous market of many users with considerable technological capacity that can be integrated into a regional or supra-regional market, and if they are coupled with early long-term-oriented, resource-intensive and focused investment plans. However, few groups of countries would be able to sustain such concerted action over a long period of time. They would find it difficult to tolerate the concentration of value capture (and thus economic growth) in only a few geographical clusters. In a single country (such as China), on the other hand, it may be easier to make policy choices that initially benefit a few selected innovation and production hubs (e.g. Shenzhen).

While only a few countries have managed to foster a thriving platform ecosystem of the kind observed in the United States and China, some developing countries have formulated specific policies aimed at enabling local platforms to grow. Ethiopia, for example, prohibits Uber, Didi and other foreign ride-sharing platforms from setting up operations. In their absence, various alternative services (such as Ride, ZayRide and ETTA) have emerged, tailored to local conditions (e.g. slow Internet speeds, and a lack of smartphones and mobile payment systems).[143] In Kenya, Uber is facing stiff competition from locally based ride-sharing companies like Little.[144] In other countries, strategic decisions by global digital platforms not to enter a certain market have created space for local ones to grow (such as Jumia Group and Souq in Africa). Thus, depending on the policy environment and market conditions, local digital platforms can be viable options also in developing countries.

Another approach is to allow local digital enterprises to scale internationally in new digital product categories while continuing to make a virtue of their geographical positioning. Innovative business models and processes that have worked well in a particular country could be explored in other markets with similar conditions, and governments could look for ways to facilitate such international reach. Market harmonization in the traditional sense of trade agreements and facilitating cross-border e-commerce (e.g. Africa's Continental Free Trade Area or the EU's Digital Single Market initiative) are useful examples in this context.

It might also be desirable to provide direct policy support to digital product markets where regional development potential and expertise coincide, such as last-mile platforms for digital payments, microfinance and digital health. Opportunities may be found, especially in niche markets (i.e. digital product categories), that are relatively unattractive for global competitors but large enough for start-ups to attain a critical mass regionally. Policy support could also

be provided for creating exchange programmes for entrepreneurs which encourage and explain to them how to internationalize.

Finally, governments may seek to support the creation of regional innovation platforms and ecosystems. In fragmented technological landscapes, such as those found in many developing countries, digital innovation cannot realize its combinatorial and inclusive potential. The challenge is to identify innovation paths with long-term potential, and work towards providing a shared, open and enabling digital infrastructure. Part of this involves better integrating existing proprietary systems, for instance by forcing mobile operators to open up and/or improve their application program interfaces within and across countries.

For identifying niche digital product categories and for digital infrastructure development, policymakers could provide incentives to different clusters within a region to develop complementary but deep technical knowledge bases. The greatest potential could be expected for digital products (a) that are hard to be replicated elsewhere, (b) that would be needed locally and elsewhere, and (c) that could be transported or duplicated in a certain location at relatively low cost. For many low-income countries, there may be more market opportunities for local or regional digital goods and services in local or regional markets than in global markets (DIODE, 2018).

4. Empowering women entrepreneurs in the digital economy

Improving women's access to the opportunities offered by the digital economy is important for bridging the gender digital divide, and for broadening the opportunities for women entrepreneurs to find jobs and earn (additional) income. This would benefit women and their families, which would enhance the well-being of society as a whole. However, in addition to the now familiar technological and economic hurdles, various individual, legislative and cultural barriers (such as inherent gender biases) exist, which prevent women in some developing countries from benefiting from the opportunities offered by e-commerce and the digital economy.

Empowerment through digital technologies involves fostering the upward mobility of women beyond the informal sector, the rural areas and micro loans/initiatives, as well as beyond subsistence levels. Various forms of financial and technical support currently provided to bridge the personal development gap are not sufficient; mentoring, networking and greater exposure to relevant role models can help overcome inherent gender biases and cultural norms that limit women's ability to confidently start or sustain projects, including in e-commerce and various data-driven technology areas.

A number of initiatives around the world are currently supporting women entrepreneurs in the technology field. For example:

- *Wireless Women for Entrepreneurship and Empowerment*, led by the Digital Empowerment Foundation in India creates women-driven ICT-based micro social enterprises. Wireless Internet supports women entrepreneurs in socially backward locations or districts, and contributes to creating an Internet environment for gender inclusion and women's empowerment.[145]
- In Haiti, *Radikal* aims to tackle poverty by providing women with the tools – including use of the Internet, social media and mobile technology – to help their micro-enterprises produce high-quality, organic products with local raw materials.[146]
- In Ghana, the *Soronko Academy,* through the Tech Needs Girls Project, has trained over 4,500 girls in eight regions in Ghana, and also in Burkina Faso, on how to code and create technology. It has decided to set up a coding and design school as a safe space where innovation can meet creativity, and where technical, problem-solving and critical thinking skills can be acquired.[147]

Concrete measures to encourage and empower women entrepreneurs to participate or become active players in the digital economy include creating better funding opportunities, and providing role models and mentoring. Another approach is to leverage new networks of women leaders in e-commerce in different developing regions. This is a way to give women leaders more visibility as role models, and provide them with opportunities to influence the policy debate at national and international levels. More dialogue between policymakers, the private sector and civil society on how to empower women in the digital economy should be encouraged at all levels, especially in developing countries. To this end, UNCTAD has launched a new *eTrade for Women* initiative.[148]

5. Supporting the digitalization of enterprises

Securing value from the digital economy requires not just strengthening the digital sector itself, but also efforts to enable enterprises across all sectors to take more advantage of digital technologies. The uptake of ICTs among enterprises, especially micro and small enterprises, in many developing countries remains limited (chapter V). With higher levels of digitalization of industries (including in agriculture or tourism), there is considerable scope for digital entrepreneurs to help develop innovative digital solutions for those industries. Firms that invest in and apply ICTs are generally in a better position to become more productive, competitive and profitable (UNCTAD, 2011).

Governments and actors involved in development activities may find it useful to learn from private sector experiences in order to intervene in ways that help enterprises and civil society seize opportunities created by developments in technology. Many small business owners in developing countries, and especially in LDCs, lack the necessary capabilities, skills and awareness to take full advantage of the digital economy. Thus, even if they have access to mobile phones or the Internet, they may not know how to leverage these tools for advancing their business operations. One way to address this issue is to integrate ICT skills development into general training curricula in business management. Depending on the beneficiaries targeted, such training may range from advice on how to use mobile phones as a business tool to more advanced training in how to use various technologies and applications to improve operational management, customer relationship management and resource planning.

There are different ways for MSMEs to gain an online presence to market their goods and services to potential buyers in their own country or in foreign markets. The introduction of digital platforms has helped overcome some traditional obstacles, such as the need for in-house resources, information technology equipment and expertise, by establishing and maintaining a web presence (UNCTAD, 2015d).

In the right circumstances, digital platforms can expand the opportunities for small enterprises in developing countries to reach new customers. However, access to global platforms and apps markets still varies greatly (UNCTAD, 2018b). Policymakers could choose to engage with the platform owners to ensure that their platforms can be fully utilized locally, and that existing regulations do not hamper access. In Egypt, for example, contacts with Google, led to the opening up of the Google Play app market for Egyptian developers, which created opportunities for them to sell their apps (UNCTAD, 2017e). Policymakers could also support training for MSMEs on how to leverage such platforms. In addition, trade promotion organizations need to tailor their services offered to small businesses in ways that are conducive to exporting in the digital economy (UNCTAD, 2017a).

C. DATA POLICIES FOR CAPTURING VALUE

Countries with limited capacity to transform digital data into digital intelligence are constrained in their potential to capture economic value from data. To prevent dependence on certain countries in the increasingly data-driven economy, national development strategies need to include the objective of digital upgrading (value addition) in data value chains, to enhance domestic capacities to move from treating data as a raw material to processing digital data and using AI. This may involve the development of national data policies and strategies with a view to both seizing the opportunities that the expansion of data can create, and dealing with various risks and challenges associated with such development. This section considers options for countries to create and capture more value from data. Key questions for governments include how to assign ownership and control over data; how to build consumer trust and protect data privacy; how to regulate cross-border data flows (CBDFs); and how to build the appropriate capabilities for harnessing digital data for development.

1. Data ownership policies

Given the strategic importance of digital data, it is necessary to understand who can control access, use and deletion of data, which are the main rights associated with the concept of data "ownership" (OECD, 2019a). Much of the data being leveraged reflect the actions and choices of online users who may be able to use various online services for "free" in exchange for sharing their data with the digital platforms they are visiting. Other digital data are the result of human-to-machine or machine-to-machine interactions. Currently, foreign companies often enter a country, build infrastructure to extract data from

various users, and then assume control over the data. If data were recognized as a public resource, however, data ownership would lie, first and foremost, within the jurisdiction of the country where they are produced.

In recent years, various proposals to ensure a more equitable sharing of the economic gains from digital data have been put forward. However, there is considerable divergence of views in this regard, and some time may be required to experiment with different policy options to better understand their respective pros and cons. Some proposals below focus on how to remunerate the individuals who are sharing their data with platforms through personal data markets or via data trusts. Others call for the use of collective data ownership.

a. Personal data markets

Personal data markets have been proposed as a way to help rebalance power from global digital platforms to the platform users (Lanier, 2014; Arrieta-Ibarra et al., 2018).[149] Under this approach, the latter are given ownership rights over their own data and the opportunity to sell (or not sell) them. The idea was tested briefly in the dot-com era, when some companies (e.g. AllAdvantage) created a platform that enabled users to sell their personal data. This platform was funded by Softbank along with some venture capital, and at its peak it was valued at $700 million (Gimein, 2000), but it went out of business in 2001.

There are some major limitations with personal data markets. Firstly, individual data are worth very little on their own (Beauvisage, 2017).[150] The real value of data comes from the data being pooled together. Secondly, the administrative costs of personal data markets can be very high. Thirdly, it is unclear how to determine ownership over personal data. For instance, in a conversation online, which participant owns the data and should have the right to sell them? Fourthly, personal data markets effectively mean turning privacy from a basic human right into a commodity to be sold. This could work against efforts to secure greater equality, with richer users being able to afford privacy, while others have a greater incentive to sell their privacy.

b. Data trusts

Data trusts have been proposed as a way to recognize the inherently collective nature of the value of data. Rather than individualizing ownership, data trusts seek to build trust between a variety of stakeholders (individuals, businesses, governments) so that they can freely and openly share data with each other (Hardinges, 2018). This may take the form of a repeatable framework that aims to build trust between those who hold data and those who need the data (Hall and Pesenti, 2017); or it may be a more permanent organizational structure with a governance mechanism in place (Select Committee on Artificial Intelligence, 2018). While this idea has some merit, in practice, under current conditions, it may result in giving away the data to large digital platforms. The mechanisms for remuneration, either collective or individual, within these schemes remain unclear. Like much of the open-source software community, data trusts risk becoming a free resource for the most powerful firms, rather than an alternative to them.

c. Collective data ownership

Some other authors have argued that data should be treated as a public resource (Lawrence and Laybourn-Langton, 2018; Mazzucato, 2018b; Singh, 2018; Tarnoff, 2018). This would mean asserting that data collected within a given jurisdiction should first and foremost belong to that jurisdiction, even if the authorities do not have the capacity to extract, collect, store or analyse them. It is argued that if the oil of a country is deemed to be that country's resource – and not the property of anyone who may have the means to extract it – similar considerations should hold for data. This would apply to data both about the physical world (e.g. agriculture or weather patterns within a country's jurisdiction) and about humans.

Collective data ownership over a country's (or a region's) data resources could, for example, take the shape of a collective data fund (Mazzucato, 2018b; Morozov, 2017). The fund would pool together the data from within a country, for example on machinery (e.g. traffic and energy), the natural world (e.g. agriculture and weather) and individuals (e.g. health and finance). The latter type of data are particularly sensitive: personal data would have to be made anonymous and be subject to strong privacy and data protection rights. People would also need to be given the right to control whether or not to opt for inclusion in the fund (akin to an organ donor programme). They would also need to have the option – but not an obligation – to control which data are collected and how they are used (for example, prohibiting the use of their data for micro-targeting).

The Decentralized Citizen Owned Data Ecosystem (DECODE) project, funded by the European Commission, aims to construct legal, technological and socioeconomic tools that will allow citizens to take back control over their data and generate more common benefits from them. In Barcelona, for example, DECODE offers a set of open-source tools and examples of how this might be achieved in practice (Meessen and Sonnino, 2018). The ability to revoke consent for any or all uses of data could also be built into the system. Overall, it would operate on the dual principles of collective ownership and individual control.

It has been argued that a public data fund could help developing countries create the infrastructure needed for data extraction comparable to the use of production-sharing agreements in the oil and gas industry (Tarnoff, 2018). The idea would be for a government to commission a company to build the necessary infrastructure for extracting the data, which would then be stored in a public data fund. The company would be able to use the data to generate revenue to recover the cost of building the infrastructure, while any remaining profits would be split between the government and the company. The government would retain ownership of the data, which would become part of the national data commons. The city of Barcelona is testing a similar system using public procurement contracts to mandate companies (such as Vodafone) to provide the government with the data they collect which it could use for the benefit of the people (Graham, 2018c). In India, efforts are under way to build a cloud-based data platform for local farmers, which would enable data to be collected and shared (though fees for access are not a feature of this model) (see box VI.2).

Proponents of collective data funds allude to a number of potential benefits. Firstly, access to the data of the collective would be democratically controlled. Governments and individuals would be able to set rules and establish control over the data that they produce. Companies could be given access to the data under regulated conditions that would take into account privacy and security concerns in particular. They could be charged for access to the data, with lower (or no) fees for small, local firms and higher fees for large platforms. This could be an alternative to introducing taxes (Carnahan, 2015).

Charging for access would lead to a second potential benefit: the ownership and value of the public data would be returned to the community rather than captured by only private companies. Revenues raised could be used to fund other government programmes and to develop the broad capacities necessary for economic growth and sustainable development.[151]

What are the potential risks involved? The collection of data under a government-run scheme may raise concerns of potential surveillance and repression of individuals' rights. Moreover, given that a country would receive the value from its collective data, there might be a built-in incentive to expand surveillance to garner more data, and therefore more value. This underlines the importance of having strong privacy and data protection regulations in place, as well as democratic control over the data (Pasquale, 2018). Ultimately, individuals would need to have the final say over which data are extracted and placed into the collective data fund, and which data are deemed to be off limits.

Box VI.2. India's FarmerZone

India offers an experiment in publicly-owned data platforms. Proposals for FarmerZone, a cloud-based, open-source collective data platform aggregating agricultural data, seek to improve the lives of small and marginal farmers. By bringing together data on weather forecasting, disease, and pest surveillance and control, soil nutrition, irrigation needs, seed selection, credit linkages and market access, the data could be used to help farmers better plan their crops, improve their output, and ensure that the data are used for the collective benefit. It is envisaged that FarmerZone will cater to all needs of the farmer – from dealing with climate change, weather predictions and soil, water and seed requirements, to providing market intelligence.

Source: UNCTAD, based on *The Times of India*, 30 August 2017, India to set up cloud-based digital platform to provide agriculture solutions to farmers at their doorsteps; and IAS Parliament, 2019.

d. Digital data commons

A collective data fund might form the basis for a "new digital data commons", with data shared under a licensing arrangement that would enable free, non-profit use of them, but requiring for-profit companies to pay for access. This open sharing of data with non-profits could facilitate research and improve public services. For instance, data could be made available to find inefficiencies and areas for improvement in agriculture or health care. They could also be used to inform policymaking, as well as to support local platform alternatives. Eventually, the collective data fund could be expanded beyond national limits, and pooled together into an international digital commons, where, instead of digital resources being guarded within private platforms, they would be available for all to use.

Beyond data, the digital data commons could also build up a library of code available to interested users. And governments could support the production of open-source alternatives. In Brazil, for example, groups that receive government funding to build software must use an open-source licence.[152] Meanwhile, India has moved towards greater government adoption of open-source software, and has tried to use procurement to incentivize its production.[153] The use of open-source software improves security by enabling users to check the code for irregularities (UNCTAD, 2012a). It also spares users from having to pay often expensive licensing fees, and helps to rebalance wealth away from the countries and companies that currently hold the majority of intellectual property rights (IPRs). The ultimate goal of the digital data commons would be to make available the tools necessary for users to be able to build their own path for leveraging data for development – from the local level to the international level. They would be a critical resource for ensuring greater digital autonomy.

2. Data protection and privacy

Policies to build consumer and Internet user trust through data protection and privacy are not new, but they have gained importance in policy discussions due to the increase in the sheer quantity of data that can be collected online about a person. Policymakers have had to amend or pass new legislation or formulate new regulations, and develop guidelines in this area. The trend is to move from measures that react to a breach of privacy to proactive measures to protect privacy (World Bank, 2018b). Countries that lack such regulations risk being cut off from international trade opportunities as many trade transactions require CBDFs that comply with minimum legal requirements.

Many social and cultural norms include a respect for privacy. While underlying privacy principles are common to several countries, interpretations and applications in specific jurisdictions differ significantly (UNCTAD, 2016). Some countries protect privacy as a fundamental human right, while others base the protection of individual privacy in other constitutional doctrines or in tort. Still others have yet to adopt data privacy protections. In Africa, for example, less than half of all countries have adopted the appropriate legislation.[154] Moreover, in many countries, the enforcement of privacy obligations is often inadequate, as authorities seek to catch up with the latest technological advances. Such differences increasingly affect individuals, businesses and international trade, and the approaches to policy-making. The extent to which people are concerned about their privacy online also varies greatly (chapter II).

Understanding different approaches to establishing more compatible legal frameworks at national, regional and multilateral levels is important for facilitating more inclusive international trade and online commerce. In this context, a first step in data regulation is to ensure the rights of individuals. Laws and regulations need to be in place to forestall the risk of personal data being stolen or breached, and for setting limits on what personal data can be collected, whether consent from the user/consumer is needed, how the data may be used, transferred or removed, and to ensure that data-driven business models are applied in a way that generates gains for society. Digital latecomers have the advantage of learning from the mistakes of the frontrunners, and while the latter are only belatedly beginning to introduce the protection of such rights, developing countries have the possibility to build a digital economy with a better (albeit still imperfect) privacy and data protection system built from the ground up.

The European Union's General Data Protection Regulation (GDPR), which took effect in May 2018, is currently the most comprehensive approach to data protection. It has introduced a series of new rights for users and responsibilities for firms. This includes data portability, meaning that users can request their data from one platform in machine-readable format to be transferred to a different platform. It also includes a "right to be forgotten" (i.e. users can request that their data be erased from searches, under specific conditions) and also for their data to be deleted. Under the GDPR, firms have to clearly specify how their data

about individuals are being used, and they must ask for prior consent to collect and use the data. All this is backed by enforcement mechanisms, including significant fines for non-compliance.

Importantly for non-EU countries, the GDPR applies to data on EU citizens, regardless of where their data are stored or processed. This means that the jurisdiction of the law effectively has a global reach, and that many companies around the world – regardless of whether they are physically located in the EU or not – will need to upgrade their privacy and data protection schemes.

There is a growing realization that countries' laws relating to data protection should start to converge (Dixon, 2018). There appears to be a push to make the GDPR somewhat like a global baseline of what may in the future become the basic standard. Brazil, India, Japan and the Republic of Korea have already introduced GDPR-like rules, and the EU is actively trying to encourage more countries to adopt them.[155] Several global digital platforms have also begun to standardize their practices across the world. Microsoft, for instance, has said it will adhere to GDPR rules as a global standard, and Apple and Facebook have both called for EU-style privacy protections.[156] With support for a new basic set of privacy and data protection standards gaining momentum, developing economies may adopt a similar approach. While regulations related to data privacy have not traditionally been associated with trade, they can have consequences for trade when, for instance, they affect CBDFs needed for the coordination of global value chains (GVCs) or for MSMEs to trade.

In addition, it is important to ensure that Internet users know the contents of data protection rules. In a recent survey of 25 economies, less than half the respondents felt at least somewhat aware of their domestic data protection rules. That proportion was particularly low in Japan (16 per cent), Canada (26 per cent), Australia (31 per cent) and the United States (33 per cent). By contrast, in Egypt, Germany and India, Internet users were the most aware, with more than 57 per cent of respondents saying that they were at least somewhat aware of the data protection and privacy rules of their country (CIGI-Ipsos, et al. 2019).

3. Data security

Increased digitalization of economic activities and the growth of data-driven business models and IoT have given rise to various security concerns. For example, as Internet-enabled devices collect sensitive information and are increasingly embedded in our surroundings, they may be an attractive target for people with malicious intent. They may seek to gather information illegally or for unlawful use, or even to manipulate the devices (e.g. the brakes or steering of a car) (UNCTAD, 2017a). Various reports also point to growing data breaches. In the United States, the country that is the most affected by such incidents, the number of reported data breaches was ten times higher in 2017 than in 2005.[157] Limited regulatory and enforcement capacity risks exposing consumers and businesses in developing countries to fraud, cybercrime and privacy abuse, as smart devices proliferate with little planning or oversight. Developing countries, in particular, need to build the capacity to counter such threats, as they are particularly vulnerable in this area at present.

Various security arrangements – physical, technical and organizational – should be used to protect data against deliberate acts of misuse. Implementing appropriate data security should consider the quality of data, the needs of individual data subjects and the entity processing the personal data (UNCTAD, 2015d). Protecting digital data and the security of the Internet should be a shared responsibility, and therefore these and related issues need to be addressed by all stakeholders. The Internet Society's IoT Trust Framework identifies core requirements that manufacturers, service providers, distributors/purchasers and policymakers should assess and embrace for assuring effective security and privacy of IoT.[158]

4. Regulating cross-border data flows

a. A balancing act

The ease with which digital data can cross national borders raises a central policy issue related to digital platforms. As the digital economy evolves, data flows become increasingly interwoven with all aspects of the world economy, including the functioning of the Internet, GVCs and international trade. Issues relating to CBDFs have been discussed since the 1970s, but with the exponential growth of digital data, they have become more contentious in international policy and trade discussions (UNCTAD, 2017a).

The policy dialogue on CBDFs is complex due to their multifaceted nature and implications (chapters II and IV). On the one hand, they can boost various economic and social activities, improve coordination of production and improve the efficiency of supply chains. They also facilitate innovation and trade.

On the other hand, they raise various public policy concerns involving national security, data privacy, law enforcement, and movement and ownership of data. Governments need to take account of these concerns when designing laws and regulations relating to CBDFs.

While digital platforms and many other companies are encouraging policymakers to allow data to flow as freely as possible, a number of developing and transition economies have contemplated, or already adopted, measures that create disincentives or barriers to CBDFs. Such measures include data localization requirements, tariffs on cross-border data transfers, bans on trade in data, privacy laws and data protection laws (Ferracane, 2017; Ciuriak, 2018). Restrictions most commonly take the form of legal requirements to store data and locate data centres within a country's borders, as well as regulations that restrict the ability to move and process personal data across borders (Swedish National Board of Trade, 2014). Stated reasons include national security interests, protecting personal privacy and data, ensuring access to information related to law enforcement, preventing flows that are deemed to challenge national public order, and the need to protect and promote economic activity within a national territory (Castro and McQuinn, 2015). Policies may also be part of a wider strategy to ensure "cyber-sovereign" control over the digital economy and society. In such cases, barriers to CBDFs have, at times, been coupled with requirements to localize and process data within a given jurisdiction (Chander and Lê, 2015; Drake et al., 2016).

b. Data flows and trade agreements

As CBDFs are increasingly important for international trade, there have been attempts to internationalize policy regimes for such flows, including in chapters dedicated to this issue in free trade agreements (FTAs), such as the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) and the United States-Mexico-Canada Agreement (USMCA), as well as in the World Trade Organization (WTO) (box VI.3). Trade provisions tend to impose constraints on national regulatory interventions.

One analysis of data localization measures imposed by different WTO Members observes that several may be in violation of WTO rules (Sen, 2018). Given that commitments by Members were made prior to the Internet era, the same paper proposed that new negotiations on this issue, during which Members would have the opportunity to clarify their commitments, would be preferable to dealing with a dispute. Finally, a data-differentiated approach to future norm-making was proposed, whereby WTO Members would make market access commitments for some types of data, allowing free flow of company data while maintaining greater regulatory space for other types of data.

Provisions relating to data flows have been proposed in the context of other trade negotiations that have not yet been concluded. For example,

- Leaked texts from the Transatlantic Trade and Investment Partnership (TTIP) exposed divergences between the United States and the EU on data protection.
- In the negotiations on the Trade in Services Agreement (TiSA) chapter on Electronic Commerce, several countries proposed exceptions to the proposals for the free movement of information. The draft TiSA text does, however, include an annex on localization measures (Burri, 2017).
- In the negotiations for a Regional Comprehensive Economic Agreement (RCEP), there has been no agreement on the inclusion of rules enabling information flows and prohibiting data localization.[159] Any eventual outcome of an agreement would have to reflect a compromise reached between proponents of free data flows (Australia, New Zealand and the Republic of Korea) and countries that adopt more cautious positions (China, India and the ASEAN group of countries).

Bilateral agreements between the EU and Japan, and the Republic of Korea and the United States, have sought to ensure free CBDFs. China's FTAs that touch upon e-commerce (i.e. the China-Australia and the China-Republic of Korea agreements) have adopted a more cautious approach. They include provisions relating to the protection of personal information but none on data/information flows.

The diversity of views points to the need for more analysis and careful consideration of the different approaches suggested. In particular, flexibilities required to enable the achievement of legitimate public policy objectives should be further analysed and discussed (Ciuriak, 2018). Privileged access to data provides a competitive advantage, which gives rise to issues of income distribution, market concentration and the absence of a level playing field for countries

Box VI.3. Data flows and the WTO

Whereas there is no consensus on the applicability of existing WTO norms to data flows, some experts (Burri, 2016; Crosby, 2016) suggest that the General Agreement on Trade in Services (GATS) is applicable, as its annex on telecommunications requires governments to allow telecommunication networks and services to transfer data or access databases stored abroad in order to supply services covered by countries' scheduled liberalization commitments. Given the increasing blurring of distinctions between goods and services in the digitalized economy, this requirement can potentially already cover several activities. Likewise, the Understanding on Commitments on Financial Services, on which certain Members have relied for their commitments, clearly states that Members shall not apply measures which prevent transfers of information or the processing of financial information (including transfers by electronic means), where such transfers or processing of information are necessary for conducting the ordinary business of a financial services supplier. Finally, data flows are considered by some as services being provided under modes 1 or 2, and different service sectors seem to be particularly relevant for data flows (e.g. "database services" and "data processing services" under the category of business services).

In January 2019, a group of 76 WTO Members confirmed their "intention to commence WTO negotiations on trade-related aspects of electronic commerce" and to "seek to achieve a high standard outcome that builds on existing WTO agreements and frameworks with the participation of as many WTO Members as possible".[a] The intention to commence negotiations is the result of the exploratory work that a group of WTO Members engaged in over the course of 2018, following the Eleventh WTO Ministerial Conference (MC11). They will be pursued as plurilateral negotiations, as there is currently no consensus among the entire membership to embark on negotiations in new areas (including e-commerce).

Those plurilateral negotiations will have to confront the divergent views that exist among the members. With respect to data, positions presented in early meetings of this group reflect mainly the views of the proponents of free-flowing data. However, some countries have also reiterated positions that, in certain situations, regulators need to impose limitations (or conditions) on such flows; that the right of countries to regulate with a view to ensuring the protection of the privacy of individuals and the security and confidentiality of information needs to be upheld; and that adequate exceptions appropriate for the digital environment must be developed in addition to the general and security exceptions already found in existing WTO agreements.

Source: UNCTAD.

[a] See Joint Statement on Electronic Commerce at: https://docs.wto.org/dol2fe/Pages/FE_Search/FE_S_S009-DP.aspx?language=E&CatalogueIdList=251085,251084,251083,251082,251086,251022,251023,251024,251025,251037&CurrentCatalogueIdIndex=4&FullTextHash=371857150&HasEnglishRecord=True&HasFrenchRecord=False&HasSpanishRecord=False.

to participate in and benefit from the data-driven economy. Given the multifaceted nature of data, it is also important to consider what would be the most suitable forum for pursuing these discussions in an inclusive manner.

5. Building skills for data-driven development

With the expansion of IoT and various data-driven business models, more companies and governments will require people with the skills needed to derive development benefits from mining big data. In order to be able to create and capture value from digital data, there is a need for specialists such as data scientists, data engineers, data architects and data visualization specialists who can convert such data into information and knowledge.[160] The ability to determine what to do with the increasing amounts of data, identifying what is valuable and what creates new business opportunities will be key. These roles, in turn, require broader skill sets, combining analytical, software and information systems skills with business acumen and communications skills. The curricula of regular education systems and professional training facilities should be adapted accordingly. This requires close dialogue with private sector stakeholders, universities and key software users, as exemplified by the activities offered by BongoHive in Zambia (box V.2).

Data analysts and scientists also need to be business savvy to help enterprises capture business opportunities from their analyses. Multiple skills that combine sound technical skills with entrepreneurial skills and vertical and business process management expertise are particularly important in this context.

Analysts of all kinds of data need to learn about new data sources, new ways of collecting data, how regulations concerning data affect what can be collected and analysed, and which kinds of technologies to adopt for secure data storage and use. The Data Analytics Raising Employment (DARE) Project of the Asia-Pacific Economic Cooperation (APEC) has recommended certain data science and analytics competencies, and proposed initiatives to close the digital skills gap (Quismorio, 2019).

D. COMPETITION POLICY[161]

1. Updating competition policy for the digital economy

Given network effects and the tendency towards market concentration in the digital economy (chapter IV), competition policy can play a major role in the creation and capturing of value. The rapid rise of global digital platforms presents new challenges for competition law and policy, and has led scholars, policymakers and competition authorities to consider the need for adapting existing frameworks to ensure markets remain competitive and contestable in the digital era.

At present, the dominant approach in antitrust policies uses the consumer welfare standard, which is based on measuring benefits or harm to consumers in the form of lower or higher prices, respectively. However, this approach is not suited to assessing the impact on competition of some business models used by global digital platforms that provide services for free (Stucke and Grunes, 2016; Khan, 2017). For example, it may not consider practices such as predatory pricing to be anti-competitive even though this can be a key element of the business strategy of dominant online platforms to grow and monopolize their markets. Such practices would not face antitrust scrutiny, as they may, in the short to medium term, result in lower prices for consumers, until competitors are driven out of the market. Another difficulty with the consumer welfare standard is that it may not be easy to conduct price analysis of online platforms providing marketplace infrastructure due to rapid price fluctuations and personalized pricing facilitated by algorithms.

Furthermore, since many online services are offered for "free" in return for gaining access to consumers' and users' personal data, price is not the most appropriate criterion in competition analysis involving online platforms. As mergers, or certain practices by dominant platforms, may cause harm to consumers in forms other than higher prices, the concept of consumer welfare may need to be broadened to include, for example, consumer privacy, personal data protection, consumer choice, market structure, switching costs and lock-in effects. Some scholars have proposed that competition investigations should focus on anti-competitive effects of platforms' control over personal data (Newman, 2014). Other authors advocate reforms to privacy and competition policy in view of the tight relationship between market share and control over data (Pasquale, 2013; Khan, 2017).

Finally, there is a growing need for competition policy to be set and enforced within regional or global frameworks. Individual countries, including developed ones, lack the legal and economic power to tackle global digital companies. However, given concerns over the impact of international competition rules on domestic industrial policies (Hufbauer and Kim, 2008), any multinational agreement in this area should avoid restricting the domestic policy space for governments to foster their local digital sectors.

The remainder of this section considers selected challenges that have emerged in recent years, and possible ways of addressing them. Special attention is given to the role of competition law enforcement, regulations and other policy measures that aim to safeguard competition in the digital economy.

2. Competition law enforcement

a. Defining the relevant market

An important step is to clarify what constitutes the relevant market of a digital platform. Digital platforms are characterized as being multi-sided and having network effects, high switching costs, economies of scale and control over data, which are all pertinent to defining the relevant market. Regarding global platforms, like Facebook and Google, each side of the platform should be defined as a separate market as long as consumers, advertisers, content providers and any other agents involved do not engage in transactions with each other. For multi-sided market definition, competition authorities need to look at not only monetary transactions, but also data flows in the market (OECD, 2016b). Competition authorities rarely consider how data can be a source of monopoly power (with some exceptions such as the European Commission and the Republic of Korea) (Graef,

2018; Jaewon, 2017). Yet, increasingly, platforms' relevant markets may often be those that are related to accessing digital data. Indeed, companies may acquire other companies in order to gain access to their data (Harbour and Koslov, 2010; Graef, 2015; Stucke and Grunes, 2016).

In the revised German competition law (of 2017), a new provision was introduced to recognize the free products or services provided by digital platforms as a market.[162] In its decision relating to Facebook dated 6 February 2019, the German Federal Cartel Office (FCO) defined the relevant product market as a "private social network market". Its analysis in defining that market included looking at the various online services called "social media" and their competitive relationships, and the direct network effects and flexibility of digital platforms in adapting their products.

b. Abuse of market power assessment

Market power assessment in the context of platforms requires analysing different criteria in the market definition. Access to and control over data are crucial for platforms, and confer possible market power– a feature reinforced by network effects.

The criteria for assessing the impact of a dominant market position need to go beyond prices. Since prices express only a partial measure of the monopoly position of a digital platform, other, complementary metrics should also be considered, such as consumer harm from impingements on privacy. For instance, do platforms use their dominant positions in order to induce people to give up private data when they otherwise would not (Stiglitz, 2017)? How may a major digital platform affect the broader ecosystem surrounding it (Coyle, 2018)? Is a merged platform likely to increase systemic risk or reduce innovation (Lawrence and Laybourn-Langton, 2018; Stucke and Grunes, 2016)? What are the impacts from large platforms buying innovative firms and start-ups?

While prices can play a role in analysing market power, broadening the criteria is essential for forestalling potential legal problems. For example, Germany's revised competition law has a new provision which defines the criteria to consider in assessing the market position of an undertaking in the case of multi-sided markets and networks: direct and indirect network effects, the parallel use of services from different providers and the switching costs for users, the undertaking's economies of scale arising in connection with network effects, the undertaking's access to data relevant for competition, and innovation-driven competitive pressure.[163] Recent cases point to the importance of considering the interface between consumer protection and data protection rules in competition law and its enforcement.

Competition authorities may also need to update their tools to prevent abusive practices by monopolies, such as predatory pricing. New rules may be needed, and existing ones updated and enforced. In India, the Government has proposed policies to prevent foreign e-commerce firms from undercutting competitors' prices.[164] In particular, most metrics of predatory pricing tend to underestimate its extent and depth, because they do not include fixed costs in the provision of a good or service. This benefits most platforms, which rely on high fixed costs and low marginal costs to scale rapidly (Howell, 2018). Likewise, regulators have tended to see low prices as a sign of loss leaders[165] rather than as predatory pricing, because they often fail to understand how undercutting prices in one area of a platform business could be significantly more anti-competitive than in a non-platform business (Khan, 2017).

c. Merger review

Updating the tools used for reviewing mergers could be another important step in addressing potential competition concerns. For example, as noted in chapter IV, it is not uncommon for global platform companies to acquire local platform companies that become successful in a particular market. However, currently in most jurisdictions, only mergers that reach or exceed a turnover or asset threshold are subject to review. Digital companies and start-ups might not be captured by the notification criteria, as they often do not reach the relevant turnover thresholds despite having a high value. Such concerns led the German FCO to add a new threshold for the notification requirement for merger control in its competition law. In addition to the worldwide turnover thresholds and this first domestic turnover threshold, transactions are now subject to merger control if the purchase price and assumed liabilities amount to more than €400 million.[166]

Merger reviews should also pay more attention to the value and control of data. In the case of mergers, data can be relevant insofar as the combination of two companies' data sets may give the merged entity more market power and create higher entry barriers. Even in mergers with data sets that

cannot be combined, the merged entity may run afoul of competition law if the two companies were competitors. Competition authorities need to look at the impact of mergers on data on a case-by-case basis, as different data sets have different characteristics, and therefore their implications for market power vary (Graef, 2018).

In some countries, reviews of acquisitions by foreign firms are routinely subject to national security requirements. It may be worth considering subjecting them to scrutiny for their development impacts as well. While competition law can be essential for protecting infant industries (Stiglitz, 2017), it is currently not sufficiently adequate for understanding the impacts of mergers or acquisitions involving digital platforms on competition and innovation. Some authorities have also proposed the implementation of a "public interest test" for data-driven mergers and acquisitions. As pointed out by the Chief Executive of the Competition and Markets Authority (CMA) of the United Kingdom:

> On the one hand, it would create uncertainty around the acquisition of companies which might discourage foreign direct investment. On the other, it would give the CMA greater flexibility to make a judgement in the public interest. Whereas at present case law and the law on consumer welfare might prevent the CMA from intervening in an acquisition even if it were concerned about the accumulation of too much data by a platform.[167]

3. Regulation as a solution

Some services provided by digital platforms could be considered akin to utilities, such as when they provide infrastructure of a public good nature that communities, consumers and users begin to rely on (Rahman, 2018a and b). In these cases, it may be necessary to consider whether it would be appropriate to regulate certain digital platforms to ensure open and fair access for all businesses so as to create a level playing field. This may be a more effective solution than addressing possible competition problems ex post under competition law. In order to be allowed to operate in a country, digital platforms could be required to adhere to these regulations and pay a licence fee that could be used to fund the regulator (Lawrence and Laybourn-Langton, 2018).

A first set of rules could focus on ensuring fair access and treatment (Rahman, 2018a), based on the principle of common carriage. Thus, a digital platform utility could be required to remain open and provide fair access to any other business or user. For example, if Facebook was deemed to be providing a universal social networking platform, there could be democratically accountable rules about when and whether users could be barred from the service. Exclusion from a basic utility should not be decided upon by a single private firm.

Another concern with dominant digital platforms has to do with neutrality. One way to ensure dominant platforms' neutrality might be to apply the "essential facilities doctrine". The incumbent would be required to provide a fair rate of access to other telecommunications operators. This would be similar to the regulation of telecommunications, where the incumbent firm usually owns or operates the infrastructure, even if it has its own telephone and/or mobile phone service. This could help prevent abuse of market dominance by platforms operating similar infrastructures, such as Apple's App Store or Amazon's marketplace, while enabling the platforms to maintain their scale of operations (Khan, 2017).

A similar focus on access could include the principle of non-discrimination, which would require that a platform provide equal treatment to everyone using the platform. For instance, if Amazon were deemed a universal e-commerce platform, it would not be allowed to privilege its own products (Amazon Basics) on its platform (Khan, 2018). Similarly, platforms would not be able to use algorithms to treat customers differently by charging different prices for the same service.

A different set of rules might seek to build meaningful forms of accountability into the utilities' operations. For instance, if the platforms' algorithms are responsible for sensitive decisions (e.g. about finances, employment, health or legal issues), they could be required to be made available to regulators in order to ensure there is no bias (Lawrence and Laybourn-Langton, 2018). In certain cases, regulators could have the right to prohibit algorithms from making important decisions.

Other rules could aim to ensure good citizenship by the companies. In return for acceptance of their monopoly position, they would be encouraged (or required) to contribute back to the countries in which they operate. This might mean investment mandates or having platforms license their IP on fair, reasonable and non-discriminatory (FRAND) terms (Kolbert,

2017; Taplin, 2017b). The aim would be to ensure that natural monopolies serve the public interest.

A number of similar proposals have been floated at national and regional levels by governments or competition authorities, mainly in developed countries. For example,

- The European Parliament has called upon the European Commission "to consider proposals aimed at unbundling search engines from other commercial services".[168]
- In France, the National Digital Council has proposed prohibiting the discrimination of suppliers that is not justified by the quality of service and/or for legitimate economic reasons,[169] and the French Parliament has passed a law imposing an obligation of "platform fairness".[170]
- The Australian Competition and Consumer Commission has proposed various regulatory measures, stating that "…the strong market position of digital platforms like Google and Facebook justifies a greater level of regulatory oversight."[171]
- A 2019 report by the United Kingdom's House of Lords compares online platforms to utilities in the sense that users feel they cannot do without them, or since they have limited choice, they accept their terms and conditions.[172] It recommends special obligations to ensure that platforms act fairly towards users and other companies, and in the interest of society, and that these be monitored by a dedicated regulator.
- In Mexico, the Federal Economic Competition Commission (COFECE) has published an advocacy paper to draw attention to the importance of the digital economy and its impact on competition policy (COFECE, 2018).

A much-debated idea is to break up dominant digital platforms to reduce the concentration of power in the hands of a single platform.[173] This subject has moved beyond those concerned with the issue of competition; it is also being debated in, for example, election campaigns in some countries, with candidates proposing that large technology companies be broken up in order to promote competition and safeguard small businesses.[174] However, some authors have cautioned that breaking up or preventing digital platform monopolies may lead to worse outcomes and do little to improve competition (Mayer-Schönberger and Ramge, 2018).

4. The need for greater international collaboration

In the developing countries that have competition authorities, these authorities tend to be relatively new and small, with limited resources to tackle competition cases in an increasingly concentrated global economy. If regulations could clearly set the rules of the game for platforms, there might be less need for ex post enforcement of competition law by authorities. For instance, e-commerce is growing, and if developing countries were to introduce appropriate e-commerce policies and regulations to ensure that MSMEs had open access to platforms under fair terms and conditions, those companies could benefit more from the digital economy. The Government of India, for example, introduced new e-commerce rules in 2018 to promote competition and prevent restrictive practices by online e-commerce platforms such as Amazon and Flipkart. One of the new rules, which came into effect on 1 February 2019, prohibits e-commerce platforms from selling products from companies in which they have an equity interest (Ministry of Commerce and Industry, India, 2018).

Another response by developing countries would be to join forces at the regional level within their regional trade and economic frameworks. Such arrangements could facilitate intraregional trade and ensure larger markets for local companies. E-commerce, competition and consumer protection polices and rules at the regional level might be more effective than at the national level in dealing with abusive practices of global digital platforms, as well as with mergers of digital companies. They could also ensure that dominant platforms remain open to local and regional companies under fair terms and conditions.

Dominant platforms and online marketplaces are global and act globally. Therefore, efforts at the regional level would be more commensurate with the scale of impact of online platforms on economies. Regional frameworks could facilitate the exchange between more experienced competition agencies and younger ones within a region. At the same time, international organizations, such as UNCTAD's Intergovernmental Group of Experts on Competition Law and Policy, and other institutions, could provide additional support.

E. TAXATION OF DIGITAL PLATFORMS

1. Issues at stake

A major challenge to development posed by digital platforms is their capacity to use tax optimization practices to avoid paying their fair share of taxes.[175] While tax avoidance is not exclusive to digital platforms, some of their inherent characteristics may facilitate their use of such practices.[176] Digital platforms rely heavily on intangible assets, which are difficult to value and measure. Since these intangibles are easy to move around the world, they provide opportunities for aggressive tax planning. Another problem is the lack of clarity on where value is produced. As discussed in previous chapters, a significant proportion of the value generated in the digital economy stems from users through the data they produce. All this allows global platforms to easily move profits from high-tax-rate jurisdictions to low ones, thereby reducing their effective tax rate. For example, in 2017 taxes paid abroad by Facebook represented only 2.9 per cent of the profits it generated outside the United States (table IV.2).

There appears to be an emerging consensus that the existing international corporate tax system is lagging behind the digital economy. There is also agreement that, as digitalization is increasingly spreading to all sectors, it would not be possible to ring-fence the digital economy (OECD, 2019e). However, there is less consensus on how to reform the current tax regime. Indeed, there is not yet a common understanding of the concept of "value creation" for taxation purposes in the digital economy. As a result, there is a disconnect between where value is created and where taxes are paid, with the result that public revenue is lower than it should be.

The main challenges relate to so-called nexus and profit-allocation rules. Under the existing system, taxation is based on physical presence or "permanent establishment" of companies in a country. This is also known as the nexus, or the connection between a business and the jurisdiction it would come under for taxation purposes. However, with increasing digitalization, many economic activities are taking place online without the need of a physical presence. Moreover, user participation on the Internet plays an important role in value creation. As this has significant implications for the concept of presence for taxation purposes, it is important to find ways to tax appropriately in jurisdictions where the value is created. A new approach is needed, which could look at digital presence in a given country based both on supply and demand (user) factors.

A related challenge is to determine how profits should be allocated between the different countries in which the activities are taking place. Under the current system, this is based on the arm's length principle, which allows transactions between different parts of an MNE to be valued as if they had been carried out between unrelated parties. In practice, it results in allowing digital platforms to artificially shift profits between different jurisdictions.

While there is wide agreement on the need for global tax reform to make the system fairer, difficulties in reaching consensus arise not least over how best to tax global digital platforms.[177] This is a concern for countries at any level of development, and it may be even more relevant for developing countries, particularly LDCs, due to their greater needs for domestic resource mobilization for development, as well as the lower capacity of their tax administrations to collect taxes. They also have less bargaining power against powerful digital platforms. Moreover, most developing countries do not physically host digital platforms, though they often contribute significantly to user-generated value as markets for digital platforms.

2. Current policy developments

The OECD is currently leading global efforts to reach an international consensus. In 2015, in the context of the OECD/G20 BEPS Project, it proposed 15 actions to respond to the problems of base erosion and profit shifting (BEPS),[178] of which action 1 was: Addressing the tax challenges of the digital economy (OECD, 2015). These were designed to close some of the loopholes that enable transfer pricing, in particular; but many of those loopholes still exist, and relatively little attention was given to a number of other problems involving the digital economy. While it has been recognized that the BEPS project represents significant progress, concerns have been raised that it has not really addressed the roots of the problem, as companies continue to be able to shift profits to low-tax jurisdictions using transfer pricing (ICRICT, 2019; BEPS Monitoring Group, 2017). Further efforts to address this issue have been in the works since then, but with little consensus to date.

In January 2019, it was announced that the 129 countries and jurisdictions participating in the OECD/G20 Inclusive Framework on BEPS would increase multilateral efforts towards reaching a consensus-based, long-term solution by 2020 (OECD, 2019f). However, low- and middle-income developing countries may have limited influence on how these rules are developed (section VI.E.3).

The OECD (2018a) Interim Report identified three main aspects of digitalized business that have significant implications for taxation: (i) the possibility to scale across borders without mass, (ii) their heavy reliance on intangible assets (such as software, algorithms or data), and (iii) user contribution to economic value through the provision of data. As part of the process towards 2020, the OECD opened a public consultation on Addressing the Tax Challenges of the Digitalisation of the Economy, which includes three proposals for revising the profit allocation and nexus rules in response to digitalization. They concern user participation, marketing intangibles and significant economic presence (OECD, 2019g).[179]

Meanwhile, numerous countries are discussing or implementing interim measures to tax the digital economy. At the regional level, the EU proposed a package on fair taxation of the digital economy in March 2018, which included, as a short-term measure, a digital services tax of 3 per cent levied on the turnover of large technology companies, and a long-term measure establishing a "virtual permanent establishment" (European Parliament, 2018a). However, one year later, in March 2019, member States had still not reached an agreement on the digital services tax. They then decided to continue to work towards an agreement on a global solution by 2020 under the aegis of the OECD to address the tax challenges of the digitalization of the economy.[180] The lack of common agreement has prompted a number of EU member States (including Austria, France, Italy, Spain and the United Kingdom) to take unilateral measures.[181]

Several developing countries have taken similar steps. In Latin America, Peru and Uruguay have moved towards imposing digital taxes. Peru was a pioneer already in 2003, with a legal change to the definition of income considered to be of Peruvian origin expanded to include payments abroad for digital services. Uruguay introduced a law in 2017 for determining the share of the income of digital platforms that should be of Uruguayan origin. In Mexico, a proposal has been made for a tax on income from digital services, similar to the EU proposal (ECLAC, 2019). In Asia, Malaysia was the second South-East Asian country, after Singapore, to plan an extension of its tax rules to cover digital supplies by foreign suppliers.[182] Other countries in Asia and Latin America that are considering possible ways to introduce new taxes on digital platforms include Chile, India, Israel and the Republic of Korea.[183] Unilateral measures are not the optimal solution, however, since they can lead to increased complexity and uncertainty.

In most parts of the world, policy efforts related to taxation in the digital economy have mostly focused on corporate taxation and on major digital platforms. In Africa, however, the main focus has been on taxation of Internet and mobile money users. Countries that are imposing taxes on Internet applications or services include Kenya, Uganda, the United Republic of Tanzania and Zambia. While this kind of taxation may be attractive to governments, it can be counterproductive if it results in a decline in economic activity by reducing the number of active Internet users.[184]

Most proposals and efforts put forth so far for the reform of the international tax system in the digitalization context are premised on outdated ideas of businesses. The current system perceives an MNE as a series of separate legal entities rather than as a unitary entity (Avi-Yonah and Tinhaga, 2019). In the latter approach, firms would be taxed based on where their economic activities take place, rather than where their legal structure indicates their activities are taking place. In practice, companies would submit accounts of their global activities and profits, as well as records of their activities in countries where they do business. Their global profits would be allocated to individual countries according to a formula that takes into account a number of variables, and individual countries could then tax the profits allocated to them. In this way, the scope for manipulating transfer pricing and using subsidiaries for moving profits around would be eliminated, since moving profits around within a unitary firm leads to the same aggregate profit.

Typically, in proposals for a common consolidated tax base (as put forward, for example in the United States and in the EU),[185] the formula for allocation includes a weighted set comprising the factors of production (i.e. physical assets and workers) and sales revenue (as an indicator of market involvement). However, with digital firms, intangible assets play a key role in generating value, and currently are not included within most apportionment formulas. At the same

time, they pose challenges for any system of unitary taxation. If intangibles are not included in the formula, countries with a larger manufacturing share will take an artificially high share of the profits (Markham, 2005). If intangibles are included, the risk is that it will provide further incentives to move the intangibles to low-tax jurisdictions, which will then appear to take on an oversized role in generating the value of the global firm. There are no easy solutions to the problem of locating intangibles, though any solution is likely to focus on where intangibles are developed (including the data produced by users of platforms). However, under the current system, the generation of value and profits are already distorted by tax planning techniques. Thus, a unitary tax system could do much to improve rebalancing the tax base of global digital platforms, and would form the basis for a twenty-first century international tax system.

The unitary approach to taxation is supported by the Independent Commission for the Reform of International Corporate Taxation (ICRICT).[186] According to this Commission (ICRICT, 2019: 12),

> The digitalisation of the economy clearly demonstrates why formulary apportionment is the efficient and equitable method to allocate taxing rights between countries. When the marginal cost of production for digital companies is zero, the revenue accruing to them is equal to a rent and it is therefore important to tax this rent effectively and fairly. Because the returns are basically rents, its taxation does not affect output

3. Enhancing developing-country involvement in global tax debates

A key issue of relevance for developing countries is the extent to which debates on the reform of the international tax architecture are inclusive and legitimate. The discussions at the OECD have been open to non-OECD members as well, through the Inclusive Framework, which by March 2019 included 129 countries.[187] The Inclusive Framework was established in June 2016, following a call by G20 leaders, but they had already endorsed the BEPS action plan in September 2013 (OECD, 2017b). As noted by the ICRICT (2019), the OECD-BEPS process was designed by developed countries, largely for developed countries, and most developing countries may not have the capacity to assess and reap its benefits.

To ensure a wider and more inclusive participation of developing countries in international discussions on taxation of the digital economy, it would be important to strengthen the United Nations Committee of Experts on International Cooperation in Tax Matters. Indeed, given its focus on issues of relevance to developing countries, the Committee is pursuing its own work on taxation in the digital economy. In October 2017, it formed a Subcommittee on Tax Challenges Related to the Digitalization of the Economy.[188] Its workplan highlights the objectives to find solutions that would avoid both double taxation and non-taxation, give preference, where practicable, to taxation of profits rather than turnover, as well as making it simple and easy to administer (United Nations, 2019a). It emphasizes that, from the perspective of developing countries, as they are mainly markets for most digital platforms and their users contribute significantly to the generation of value and profits, their authorities should have the right to tax such platforms. Thus, in the digital economy, both supply and demand factors should be considered when determining the nexus for taxation purposes.

Moreover, the follow-up and review of the Financing for Development outcomes and the means of implementation of the 2030 Agenda for Sustainable Development has acknowledged that "any consideration of tax measures in response to the digitalization of the economy should include a thorough analysis of the implications for developing countries, with a special focus on their unique needs and capacities" (United Nations, 2019b : 3).[189]

A final aspect to consider is that, while global digital platforms, and MNEs in general, are the main companies that engage in tax optimization practices, these essentially result from tax competition practices among countries. Proposals for establishing minimum tax rates could be another way to reduce the incentives for such companies to shift profits among countries.[190]

F. INTELLECTUAL PROPERTY RIGHTS POLICIES IN THE DIGITAL ECONOMY

Intellectual property rights (IPRs) play an important role in the creation and protection of the technologies that make up the digital economy. Copyrights, patents, trade secrets and designs accord varying degrees of protection to computer software, digital platforms, digital devices and applications. In addition, IPRs protect the assets being traded, such as electronic

music, literature and data produced by platforms and AI applications. While digital technologies have developed rapidly, the IP legal framework is not up to date. For developing countries, this can represent both opportunities and challenges. Most countries lack specific policies on IP in the digital context.

The fundamental purpose of IP regimes is to strike an appropriate balance between the interests of creators and inventors, on the one hand, and users and consumers on the other. This has become more difficult in the digital environment, where electronic copies of original works may be reproduced in an unlimited number, potentially threatening traditional businesses in publishing, printing and bookselling. In addition, digital copies may be shared across borders, while IPRs are limited to national jurisdictions.

On the other hand, how can the rights of consumers and competitors be transferred from the analog to the digital format? Someone who purchases a patented or copyrighted physical product is free to resell it to third parties. May someone who legitimately acquires a digital copy of a song or a movie equally sell it to others, considering the possibility of unlimited electronic copying and public distribution (Okediji, 2018)?[191] Also, to what extent is the reverse engineering of protected computer programs, which is essential for developing-country software developers, comparable to the mere reading of a copyrighted book in an analog format? Some developed countries have addressed these issues of the digital environment by limiting the space that copyright provides in the analog format (Samuelson and Scotchmer, 2001).

Balancing the interests of rights holders and users is not only important in the context of digital technologies, but equally in respect of the data that may be generated from these technologies via online platforms. While the data collected by a search engine are not eligible for patent protection, data as such (for example information regarding consumers' priorities for certain products or services) may be protected as a trade secret, and some forms of data collection (especially if there is a degree of creativity in their selection or arrangement) may qualify for copyright protection under or in certain *sui generis* data protection regimes. Policymakers face a difficult task of striking a fair balance between incentives to collect and process data (e.g. to encourage AI applications), and the need to allow the sharing of data to encourage big data analysis and the improvement of products and services.

Digital platforms can create difficulties for IP enforcement and consumer protection. For instance, are platforms liable if content produced by their users infringes IPRs? The proposed *EU Directive on Copyright in the Digital Single Market* has faced opposition for its alleged obligation for platforms to install "upload filters" to separate infringing content from non-infringing content. The discussion pits arguments in favour of effective IP enforcement against concerns about automated decisions that replace human case-by-case judgment, which could potentially ban unprotected content by mistake.[192]

In some cases, where legislation has been slow to evolve, the private sector has sought to fill the gap through voluntary commitments. For example, open-source software is based on copyright, but rights holders can authorize third parties to change and disseminate the program under certain conditions. This reflects the belief that in a sharing economy, the consumer may also be a creator, contributing to continuous improvements to the underlying technology.

A collaborative approach is also required where the development of new products depends on the interoperability of digital technologies held by various rights holders. Interoperability is ensured through technical standards that are developed by standard-setting organizations, such as the ITU or private organizations. For example, cellular communication standards (the latest being 5G) involve a multitude of IPRs. Standard developers rely on patent and copyright owners' good faith disclosure of any IPR claim and the provision of licences on FRAND terms. If IP owners conceal their claims or refuse FRAND, the deployment of the standard will be in jeopardy unless IP law or competition regulations can address the problem. For instance, the United States Federal Trade Commission has sued Qualcomm, which holds standard essential patents on 4G technology, for having refused access to 4G for its customers like Apple unless they agreed to patent-licensing terms more favourable to Qualcomm than FRAND terms.[193]

Another IP-related issue can be illustrated by the worldwide clash over several years between Apple and Samsung over IP-protected smartphone and tablet technologies and design. It demonstrates how, due to the territorial nature of IP law, courts in different jurisdictions may reach different conclusions on the infringement of software and device patents by competing technologies.[194]

International IP law leaves developing countries the flexibility to design domestic laws and regulations for digital value creation, but it does not offer much guidance. Some countries have therefore emphasized the need for multilateral exchange and sharing of experiences at the WTO.[195] What is clear is that IP systems need to adapt to changes wrought by digitalization, and that more studies are needed to consider the implications for developing countries.

G. LABOUR MARKET AND SOCIAL PROTECTION POLICIES

Digitalization can have significant impacts on employment and working conditions, and thus on the quantity and quality of jobs (chapter IV). The rapid pace of digital transformation requires policymakers, as well as individuals, to react quickly to adapt to technology-induced changes in the labour market. As the nature of work changes, and new jobs emerge while others disappear, individuals need to learn new skills over the course of their working lives. Therefore, a critical element in the policy kit for creating and capturing value in the digital economy is the establishing of appropriate lifelong learning programmes for the labour force to make it be better prepared, and more resilient and adaptable to these changes (UNCTAD, 2017a).

Policymakers also need to consider ways to help those individuals that may lose their jobs due to increasing digitalization to cope with and adapt during the transition process. Special social protection measures and safety nets are important in this context. One widely debated and controversial policy option is to provide a "universal basic income" (UNCTAD, 2018a). Moreover, issues related to the portability of labour benefits and rights deserve greater attention, as work has become more mobile in terms of time and space, particularly in the virtual world.

The increase in digital platform work may facilitate work flexibility and increase job opportunities, particularly in developing countries. However, there is also the risk of a "race to the bottom", in terms of labour conditions and standards, which needs to be addressed. A major issue in this regard is the classification of jobs (i.e. whether the worker is considered an employee of the platform or an independent worker) (De Stefano and Wouters, 2019). This has significant implications for labour rights, but remains unresolved to date, and is open to interpretation. Currently it is the platform owners that unilaterally stipulate the working conditions on their platforms through their terms of service agreements. Often, this means that compensation for crowdwork is lower than minimum wages, workers must manage unpredictable income streams, and they often work without the standard labour protections of an employment relationship. Yet such working conditions do not have to be an inherent feature of digital work. There is considerable scope to revise terms of service to provide for better working conditions.

Indeed, several initiatives are encouraging platforms and clients to improve working conditions. For example:

- In 2018, the New York City Council authorized the city's taxi regulator, the Taxi and Limousine Commission (TLC), to establish a method for determining a minimum payment rate for drivers working for a ride-hailing app, aimed at paying them $17.22 an hour, or $15 an hour after expenses such as gas.[196]
- Fair Crowd Work collects information about various "platform-based work" from the perspective of workers and unions. It offers ratings of working conditions on different online labor platforms based on surveys of workers.[197]
- Turkopticon is a third-party website and browser plug-in for the Amazon Mechanical Turk (AMT) platform that allows workers to rate clients who post tasks. And the Dynamo Guidelines for Academic Requesters on AMT have been developed to ensure that workers are treated with respect.[198]
- The Crowdsourcing Code of Conduct is a voluntary pledge initiated by German crowdsourcing platforms. The signatory platforms, in cooperation with the trade union, IG Metall, have also established an "Ombuds Office" through which workers can report disputes with platform operators.[199]

There is greater potential to regulate *local* "gig work" allocated through apps, as it is performed in a local jurisdiction, than globally dispersed crowdwork. In the case of the latter, platforms are located in one jurisdiction, clients in another, and workers are spread throughout the world. Thus, even if platforms agreed to comply with regulations in local jurisdictions, they

would struggle to implement laws emanating from scores of countries. This suggests the need for international labour standards that would regulate minimum conditions for platform work throughout the world.

The organization of workers in the digital economy is an important aspect to consider. As workers on digital platforms become increasingly atomized, and geographically dispersed, it becomes more difficult for them to organize and participate in social dialogue and collective bargaining. Moreover, the concentration of global digital platforms limits workers' bargaining power. A comparative study of several countries on industrial relations and social dialogue found that "There generally seems to be a lack of formal worker organisation among platform workers everywhere in the world and the few workers that do organise mainly work for [the] transport platform sector as in Europe" (Akgüç et al., 2018: 2).[200] In this context policymakers need to ensure that the value, in terms of productivity gains that may emerge from digitalization, is distributed in a fair manner between labour and capital.

Labour market and social protection policies may be easier to implement in developed economies where labour market institutions are more evolved than in developing countries. Developing countries generally also lack sufficient resources for social protection purposes. According to the ILO (2015), social protection is available on an adequate basis to only about one quarter of the world´s population. Thus, these policies remain of considerable relevance for all countries to address the negative impacts of digitalization on employment and working conditions.[201]

With a view to developing ideas on how to manage and leverage the transformation in the world of work, the ILO has established the Global Commission on the Future of Work. Its report titled *Work for a Brighter Future* (ILO, 2019) calls for reinvigorating the social contract, giving working people a just share of economic progress, and respecting their rights and protections. This requires action by governments, and employers' and workers' organizations. It provides recommendations for a human-centred agenda for the future of work in three areas where more investment is needed: (i) in people's capabilities, (ii) in the institutions of work, and (iii) in decent and sustainable work.

H. THE NEED FOR INTERNATIONAL SUPPORT

Ensuring that digital transformation contributes to more inclusive outcomes and to helping achieve the SDGs requires that national efforts in developing countries are better supported by the international community. Effective international dialogue is essential to enable cross-country learning as well as to explore common policy solutions at both regional and global levels. In addition, official development assistance (ODA) to bolster the development of productive capacity in the digitalization context is critical, particularly for LDCs. This should include efforts to improve technological capabilities, including digital capacities, in countries, and their knowledge about the workings of the data-driven digital economy. These aspects should be incorporated into development partners' aid policies and technical assistance programmes.

Aid policies and decision-makers worldwide are increasingly recognizing that digitalization creates both opportunities and risks, and that there is a need for further exploring how ODA could contribute to digitalization for development (also known as digital for development or D4D). Recent estimates of international aid flows suggest that only a small fraction of ODA is explicitly addressing the development implications of digital transformations (UNCTAD, 2019d). This may reflect the fact that digitalization for development is a relatively new domain for ODA, and that many donors have only recently started to give it due attention through dedicated strategies and resource allocations.

According to the 2017 *OECD/WTO Aid for Trade Review*, which included an analysis of ODA over the period 2002–2015, the share of aid for ICT in total aid for trade is small and declining, falling from 3 per cent during the baseline period (2002–2005) to only 1.2 per cent in 2015 (OECD and WTO, 2017). In absolute amounts, such ODA peaked in 2013, when it reached $800 million (at 2015 prices). Most of this support was provided in the form of technical assistance for institutional and human capacity-building in the area of ICT regulations. A more recent study found that only 1 per cent of project funding in developing countries by multilateral development banks (MDBs) had gone to ICT projects. The study also noted that MDB support to regulations and policies relating to the ICT sector amounted to less than 5 per cent of total MDB commitments to that sector (World Wide

Web Foundation and Alliance for Affordable Internet, 2018).[202] And in the case of the European Commission, only €250 million of a total aid budget of €30 billion (i.e. less than 1 per cent) was spent in 2017 on areas of relevance to digitalization.[203]

In order to gain a better idea of the size and nature of donor support to developing countries that aims to strengthen their readiness to engage in and benefit from the digital economy, a survey was undertaken of major public and private sector donor organizations.[204] It found that donor strategies and policies in support of digital economies in developing countries vary. Several donor organizations have developed strategies that emphasize the potential benefits of D4D in terms of promoting inclusive and sustainable economic growth. However, only a few provide a clear vision for, or approach to, the mitigation of potential downside risks, such as harmful concentration and monopoly power, rising inequality, or State and corporate use of digital technologies to control, rather than empower, citizens.

Donors have dedicated a large part of their assistance to digital solutions in support of the SDGs. Some donor contributions are indirect (e.g. supporting digital identity verification systems as a prerequisite for access to government services and, in the longer run, poverty reduction). The level of donor support to the different SDGs varies. Emphasis has been mainly on health (SDG 3), education (SDG 4), decent work and economic growth (SDG 8), and industry and infrastructure (SDG 9), while the other SDG areas have attracted relatively little attention. It was unclear from the survey, whether these differences were due to variations in donor priorities, developing-country priorities, inherent differences between the SDGs, or to other factors (UNCTAD, 2019d).

A variety of instruments have been used to foster D4D, such as promoting digital innovation and start-ups through incubators, grants and competitive awards, as well as the exchange of information via online platforms, webinars and toolkits. In addition, indicator and index systems have been devised to measure the status and evolution of digital economies. Cooperation through donor alliances, including with actors in the private sector, and multi-stakeholder approaches are common. Many donors contribute to and participate in D4D-related forums such as UNCTAD's eCommerce Week, the World Summit on the Information Society Forum and the Internet Governance Forum. However, to date, there is no forum dedicated to facilitating donor exchange and peer learning in matters of support to the SDGs through digitalization.

More research is needed to document the benefits or costs accruing to countries through digitalization. While statistics showing its benefits are sometimes provided in strategy papers and project descriptions, there is need for more evidence to verify such information objectively. Opportunities and risks from digital economies in developing countries represent two sides of the same coin. Selected donor initiatives aimed at mitigating risks are related to impacts on those working on digital platforms, in cybersecurity, skills development and e-waste management. The donor survey mentioned above resulted in 10 specific recommendations to help ensure that the digital dimension would become more adequately reflected in development cooperation strategies (box VI.4).

I. CONCLUSIONS: A DIGITAL ECONOMY FOR THE MANY, NOT JUST THE FEW

Digital technologies have the potential to greatly affect the achievement of the SDGs, by both enabling and hampering progress. The net impact will depend on policy decisions taken at national and international levels. As indicated by this Report, current trajectories are not sustainable. Two countries – the United States and China – have, to date, been the most successful at taking advantage of the digital economy, and they are also leading investments in R&D and innovation related to blockchain technologies, AI and cloud computing (chapter I). The rapid rise of global digital platform firms from the United States and China illustrates the huge potential for value creation and capture from collecting data and translating those data into digital intelligence. Indeed, in the data-driven economy, the companies controlling the data value chains stand the best chance of becoming the lead firms also in sectoral value chains.

While individuals and small businesses, together with the increase in IoT-related devices, contribute significantly to the rapid growth and profitability of data-centric businesses, they have little influence over compensation arrangements for their data. Meanwhile, characteristics inherent in the business models of digital platforms, coupled with strategic measures taken by those firms, tend to accentuate the already high degree of market concentration over time, raising the barriers to entry for new competitors.

Box VI.4. Actions to enhance the digital dimension in development cooperation

Recommendations to donors

- Establish an alliance of donor agencies – for example, through the OECD's Development Assistance Committee (DAC) or other international forums – to document, exchange and promote good standards and practices in donor support to digital economies in developing countries, with special emphasis on digital inclusion and leaving no one behind.
- Improve the alignment of donor support in this area.
- Promote broad-based awareness of the opportunities and risks of digital economy development among partners in developing economies, to strengthen local ownership and stakeholder empowerment, as well as within donors' home constituencies.
- Develop and apply viable concepts and tools for evidence-based, results-oriented, and unbiased monitoring and evaluation of outcomes and impacts of related donor interventions.

Recommendations to policy- and decision-makers in developing countries

- Promote an open public debate and regional and international peer exchange to improve own strategies and programmes and align international assistance addressing opportunities and risks of digital development in achieving the SDGs and national policy objectives.
- Reinforce own systems of impact monitoring, evaluation and reporting of digital economy impacts on the achievement of the SDGs.
- Adopt and implement national strategies and programmes for digital development, drawing on the results of independent and evidence-based reviews, such as UNCTAD's eTrade Readiness assessments.
- Integrate donor support to digital economies into local systems of resource mobilization and allocation, including national planning and public financial management systems.

Recommendations to relevant UN agencies

- Facilitate donor dialogue through existing channels, such as the eCommerce Weeks, the eTrade for all initiative and the OECD DAC, and foster efforts to adopt and apply good practices, create synergies and enhance aid efficiency in donor support to harness development gains from the digital economy.
- Facilitate the design and implementation of strategies and programmes within the United Nations system that will provide efficient and effective support in relevant areas.

Source: UNCTAD, 2019d.

If left unaddressed, the yawning gap between under-connected and hyper-digitalized countries will widen, thereby exacerbating existing inequalities. Digital divides, differences in readiness and the high concentration of market power in the digital economy all point to the need for new policies and regulations aimed at ensuring a fair distribution of the gains from digital disruptions. This will not be easy. This Report has pointed to various policy options for governments to consider for fostering digital entrepreneurship, skills development, competition, taxation and employment. But there are few simple solutions, and even fewer that are tried and tested. Moreover, there is a general shortage of reliable evidence and statistics to support evidence-based policy-making and effective monitoring of progress.

On the one hand, given the highly diverse situation among countries, individual governments will need considerable freedom to regulate the digital economy for legitimate public policy and development objectives. The handling and regulation of digital data are particularly complex challenges, as they involve human rights, trade, economic value creation and capture, law enforcement and national security. Thus, finding suitable policies that can factor in all the various dimensions of digital data and data flows is difficult, but increasingly necessary. Ensuring an effective distribution of potential gains from digitalization as well as coping with various digital disruptions will also require more social protection measures and greater efforts to reskill workers (UNCTAD, 2017a).

On the other hand, many policy challenges can only be effectively addressed at regional or international levels. For example, the highly fragmented nature of laws and regulations affecting the protection and security of data, and the cross-border flows of such data, is a far from optimal situation, as it causes uncertainty about which rules apply in different situations. Other areas in which regional or global policies may be needed include competition, taxation and trade. Finding suitable solutions in these areas will require effective international collaboration and policy dialogue, with the full involvement of developing countries. Any consensus will have to include sufficient flexibilities to satisfy all countries.

Given the complexity, and sometimes novelty, of the issues involved, and the rapidity of technological change, it will be necessary to continuously assess the benefits and disadvantages of different policy options in the coming years. Some countries are already making use of regulatory sandboxes with a view to testing new technologies, innovations and policy approaches.[205] Such policy experimentation may be a useful first step before progressing towards global solutions in some areas.

In the meantime, the development community needs to explore new ways of supporting the countries that are trailing in their readiness to participate in and take advantage of the digital economy. All development cooperation agencies should consider how to fully integrate the digital dimension into their strategies with a view to ensuring that digital disruptions help rather than hinder the achievement of different SDGs and related targets. As has been noted in this Report, current levels of support are inadequate. Assistance should seek to reduce the digital divides, strengthen the enabling environment for value creation in the digital economy, build capacity in the private and public sectors, and enhance trust by supporting the adoption and enforcement of relevant laws and regulations.

Notes

135 See: https://unctad.org/en/pages/publications/e-trade-readiness-assessment.aspx

136 See, for example, UNCTAD, 2018f.

137 See UNCTAD, 2016.

138 See also UNCTAD (2018e) for a detailed discussion on policies for transformational entrepreneurship in LDCs.

139 See: https://i4policy.org/.

140 UNCTAD is supporting the development of holistic approaches for transformative policy-making relating to science, technology and innovation (STI) that advance an inclusive and sustainable development agenda tailored to each country's specific concerns, priorities, development trajectories and policy needs (UNCTAD, 2019c).

141 See also UNCTAD, 2018e.

142 See also *Al Jazeera*, 19 April 2015, Lowered expectations for Ghana's Hope City?

143 See, for instance, *Quartz*, 23 November 2016, Ethiopia's 'Ubers' are working with little internet, few smartphones and no funding.

144 See, for example, *Tech in Africa*, 21 June 2018, Little ride-sharing startup gives Uber stiff competition in Kenya.

145 See Wireless Women for Entrepreneurship and Empowerment, at: http://defindia.org/w2e2/.

146 See: http://radikal.co/.

147 See: http://www.soronkoacademy.com/about.html.

148 See: https://etradeforall.org/etrade-for-women/.

149 See also *The Wall Street Journal*, 20 April 2018, Want our personal data? Pay for it; and *The Economist*, 11 January 2018, Should Internet firms pay for the data users currently give away?

150 For example, Facebook's average quarterly revenue per user, for instance, is only about $6 – and that is before costs are factored in (Facebook, 2018).

151 It has been suggested that, eventually, revenue from a collective data fund could be used to finance a sovereign wealth fund or even a basic income to contribute to poverty alleviation (Ravallion, 2019).

152 See *The New York Times*, 29 March 2005, Brazil: Free software's biggest and best friend.

153 See *ZDNet*, 31 March 2015, Indian Government mandates use of open source software.

154 See UNCTAD Global Cyberlaw Tracker, at: https://unctad.org/en/Pages/DTL/STI_and_ICTs/ICT4D-Legislation/eCom-Global-Legislation.aspx.

155 See *The New York Times*, 24 May 2018, GDPR, a new privacy law, makes Europe world's leading tech watchdog; and *The New York Times*, 31 August 2018, India pushes back against tech 'colonization' by Internet giants.

156 See *ZDNet*, 24 May 2018, Microsoft: We're giving you all Euro-style GDPR rights over how we use your data; and *Financial Times*, 24 October 2018, Apple and Facebook call for EU-style privacy laws in US.

157 See Priceconomics (blog), Why security breaches just keep getting bigger and more expensive, at: https://priceonomics.com/why-security-breaches-just-keep-getting-bigger-and/.

158 See Internet Society, OTA IoT Trust Framework, at: https://www.internetsociety.org/iot/trust-framework/.

159 The RCEP negotiations involve 16 countries: the 10 members of the Association of Southeast Asian Nations (ASEAN), plus Australia, China, Japan, India, New Zealand and the Republic of Korea.

160 A report by the World Economic Forum (2018) on the future jobs market, identified the top two emerging jobs as being data analysts and scientists, and AI and machine-learning specialists. Other jobs among the top 10 included software and applications developers, big data specialists, digital transformation specialists and new technology specialists. See also European Schoolnet, The e-Skills Manifesto 2016, at: http://www.eun.org/resources/detail?publicationID=902.

161 Much of this section draws from UNCTAD, 2019a.

162 See German competition law, at: https://www.gesetze-im-internet.de/englisch_gwb/englisch_gwb.html#p0024, section 18(2a): The assumption of a market shall not be invalidated by the fact that a good or service is provided free of charge.

163 See German competition law, section 18(3a).

164 See *The New York Times*, 31 August 2018, India pushes back against tech 'colonization' by Internet giants.

165 Loss leader is a pricing strategy whereby a product is sold at a price below its market cost to stimulate other sales of more profitable goods or services.

166 Section 35 (1(a)) of the German competition law.

167 See United Kingdom, House of Lords, Select Committee on Communications, 9 March, 2019, Regulating in a digital world, at: https://publications.parliament.uk/pa/ld201719/ldselect/ldcomuni/299/299.pdf, p.40.

168 European Parliament, Supporting consumer rights in the digital single market (Resolution) 2014/2973 (RSP).

169 Conseil National du Numérique, May 2014, Neutralité des plateformes: Réunir les conditions d'un environnement numérique ouvert et soutenable (Avis n°2014-2), at: https://cnnumerique.fr/files/2017-09/CNNum_Rapport_Neutralite_des_plateformes.pdf.

170 Loi n° 2016-1321 du 7 octobre 2016 pour une République numérique (1), Article 49; available at: https://www.legifrance.gouv.fr/affichTexteArticle.do;jsessionid=6D0091B86AC5EB08737D2E1A0AF5539D.tplgfr37s_3?cidTexte=JORFTEXT000033202746&idArticle=LEGIARTI000033205188&dateTexte=20161009.

171 ACCC Digital Platforms Inquiry: Preliminary report, December 2018, at: https://www.accc.gov.au/system/files/ACCC%20Digital%20Platforms%20Inquiry%20-%20Preliminary%20Report.pdf.

172 United Kingdom, House of Lords, Select Committee on Communications, 9 March 2019, Regulating in a digital world.

173 United Kingdom, House of Lords, Select Committee on Communications, 9 March, Regulating in a digital world. See also Wu, 2018.

174 See *Bloomberg*, 8 March 2019, Warren calls for breakup of tech companies like Amazon, Facebook.

175 See also, UNCTAD, Trade and Development Report 2019 (forthcoming).

176 Digitalization can have implications for different types of taxes, such as corporation tax, value added and sales taxes from e-commerce, trade tariffs and taxation of users of platforms for economic activity. In the context of this Report, given the importance of data in value creation in the digital economy and the role of digital platforms in value capture, the focus of this section is mainly on corporate taxation of digital platforms.

177 For example, one proposal would have digital platforms taxed on their targeted ad revenues (*The New York Times*, 6 May 2019, A tax that could fix big tech).

178 See https://www.oecd.org/tax/beps/beps-actions.htm.

179 For details on the OECD's Public Consultation on the Tax Challenges of Digitalisation, including public comments, see: https://www.oecd.org/ctp/beps/public-consultation-tax-challenges-of-digitalisation-13-14-march-2019.htm.

180 For the timeline of discussions on digital taxation at the EU, and corresponding documents, see: https://www.consilium.europa.eu/en/policies/digital-taxation/.

181 See Hadzhieva (2019) for detailed information on different unilateral tax measures being adopted around the world.

182 See Taxamo (blog), Malaysia passes bill to tax foreign-supplied digital services, at: https://blog.taxamo.com/insights/malaysia-digital-tax-annoucement.

183 See *Wall Street Journal*, 28 October 2018, Facebook, Google may face billions in new taxes across Asia, Latin America. For reviews of different developments by country, see AICPA, 2019; SAICA, 2019; and Bunn, 2018. See also EY, Digital Tax Development Map, at: https://www.ey.com/gl/en/services/tax/ey-digital-tax-development-map; Taxamo (blog), Digital tax trends: International plans to tax the digital economy, at: https://blog.taxamo.com/insights/international-digital-tax-trends; and Quaderno (blog), Digital taxes around the world: What to know about new tax rules, at: https://quaderno.io/blog/digital-taxes-around-world-know-new-tax-rules/.

184 See, for instance, *The Guardian*, 22 February 2019, Millions of Ugandans quit internet services as social media tax takes effect; Limpitlaw, 2019; Mozilla, 2018 and Sarpong, 2018.

185 For the European Commission's proposal, see: https://ec.europa.eu/taxation_customs/business/company-tax/common-consolidated-corporate-tax-base-ccctb_en; and Krchniva, 2014.

186 The Commission is chaired by José Antonio Ocampo (see: https://www.icrict.com/).

187 For the list of countries, see OECD, Members of the Inclusive Framework on BEPS (Updated: March 2019), at: http://www.oecd.org/tax/beps/inclusive-framework-on-beps-composition.pdf.

188 For the mandate of the Subcommittee, see United Nations, 2018; See also UN-DESA, 2018; and UN-DESA, Report of the sixteenth session Committee of Experts on International Cooperation in Tax Matters, 2018, at: https://www.un.org/esa/ffd/ffd-follow-up/tax-committee.html.

189 The specific concerns of developing countries with regard to taxation in the digital economy are also highlighted in ATAF, 2019a and b; and G-24, 2019.

190 See, for instance, OECD, 2019e; and IMF, 2019c.

191 Rights holders have responded by increasingly licensing digital content, rather than transferring property, thereby keeping the right to control further distribution of the content.

192 See *Intellectual Property Magazine*, November 2018, Striking the right balance, p. 30; Broken internet, p. 31; The meme machine p. 32.

193 For a recent overview, see *The Washington Post*, 2 May 2019, DOJ weighs in on FTC's case against Qualcomm.

194 The case was initiated in 2011 and finally settled in 2018. See *The New York Times,* 27 June 2018, Apple and Samsung end smartphone patent wars.

195 *Joint Statement on Electronic Commerce. Electronic Commerce and Copyright*. Communication from Brazil and Argentina, JOB/GC/200/Rev.1 of 24 September 2018.

196 See, for instance, *Quartz*, 8 August 2018, Uber said raising driver pay couldn't be done. That's about to change.

197 See: http://faircrowd.work/.

198 See: http://www.wearedynamo.org/.

199 The Code of Conduct is available at: http://crowdsourcing-code.com/.

200 See also Johnston and Land-Kazlauskas, 2018.

201 For detailed discussions on labour market and social protection policies in the context of digitalization, see OECD, 2018 b and c; Neufeind et al., 2018; European Parliament, 2018b; Eichhorst, 2017; Pombo et al., 2018; Artecona and Chau, 2018. See also the Report of the High-Level Expert Group on The Impact of the Digital Transformation on EU Labour Markets at: https://ec.europa.eu/digital-single-market/en/high-level-expert-group-impact-digital-transformation-eu-labour-markets.

202 The study's sample focused on projects specifically identified by MDBs as ICT projects and/or projects deemed by the authors to include an "ICT component that superseded components pertaining to other sectors". Inclusion of investments for digital solutions in projects outside the ICT sector in the narrow sense might result in higher estimates of total donor allocations to the digital economy in developing countries.

203 Statement by Mariya Gabriel, EU Commissioner for Digital Economy and Society at the UNCTAD E-Commerce Week 2018, 17 April.

204 The survey was undertaken by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) on behalf of UNCTAD (UNCTAD, 2019d).

205 The first regulatory sandbox was launched in 2015 in the United Kingdom, and generated interest among regulators and innovators around the world. In early 2018, there were more than 20 jurisdictions actively implementing or exploring the concept, including some developing countries (see UNSGSA, 2018).

REFERENCES

Aaronson SA (2018). Data is different: Why the world needs a new approach to governing cross-border data flows. CIGI papers no. 197. Centre for International Governance Innovation, Waterloo, ON.

ABS (2019). Measuring digital activities in the Australian Economy. Paper prepared for the Economic Commission for Europe Conference of European Statisticians, Eighteenth session, Geneva, 10-12 April 2019. Available at: https://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/ge.20/2019/mtg1/Australia_2.pdf.

ACS (2018). Blockchain innovation. A patent analytics report. IP Australia, Sydney.

ADB (2018). *Asian Development Outlook 2018: How Technology Affects Jobs.* Asian Development Bank, Manila.

AFD (2017). Etude sur l'innovation numérique en Afrique et dans les pays émergents. Etat des lieux de l'innovation numérique et éléments de benchmark. Agence Française de Développement. Available at: https://www.afd.fr/sites/afd/files/2018-05-05-57-55/etude-innovation-numerique-afrique-pays-emergents.pdf.

Afolabi et al. (2018). Evolution of wireless networks technologies, history and emerging technology of 5G wireless network: A review. *Journal of Telecommunications System & Management*, 7(3): 1–5.

African Development Bank, ADB, European Bank for Reconstruction and Development and Inter-American Development Bank (IDB) (2018). *The Future of Work: Regional Perspectives*. Available at: https://publications.iadb.org/en/future-work-regional-perspectives.

Agrawal A, Horton J, Lacetera N and Lyons E (2013). Digitization and the contract labor market: A research agenda. NBER Working Paper No. 19525. National Bureau of Economic Research, Cambridge, MA.

Ahmad N and Ribarsky J (2018). Towards a framework for measuring the digital economy. Paper prepared for the 16th Conference of IAOS at OECD, Paris, 19-21 September 2018. Available at: http://www.oecd.org/iaos2018/programme/IAOS-OECD2018_Ahmad-Ribarsky.pdf.

AICPA (2019). Taxation of the digitalized economy: A policy paper designed to educate, enlighten and stimulate discussion. Association of International Certified Professional Accountants. Available at: https://www.aicpa.org/content/dam/aicpa/advocacy/tax/downloadabledocuments/201810-taxation-of-the-digitalized-economy.pdf.

Akgüç M, Beblavý M, Cirule E and Kilhoffer Z (2018). Industrial relations and social dialogue in the age of collaborative economy (IRSDACE): Comparative Report. Research paper. Jobs & Skills Unit, Centre for European Policy Studies (CEPS), Brussels.

Akinloye D (2018). Jumia's major investor reportedly planning to withdraw. Available at: https://www.pulse.ng/news/business/jumias-major-investor-reportedly-planning-to-withdraw-id8128909.html.

Albiman MM and Sulong Z (2017). The linear and non-linear impacts of ICT on economic growth of disaggregate income groups within SSA region. *Telecommunications Policy*, 41(7): 555–572.

Alliance for Affordable Internet (2018). 2018 Affordability Report. Available at: https://a4ai.org/affordability-report/.

Alvarez SA, Barney JB and Anderson P (2012). Forming and exploiting opportunities: The implications of discovery and creation processes for entrepreneurial and organizational research. *Organization Science*, 24(1): 301–317.

Alvedalen J and Boschma R (2017). A critical review of entrepreneurial ecosystems research: Towards a future research agenda. *European Planning Studies*, 25(6): 887–903.

APEC (2018). *APEC Regional Trends Analysis: The Digital Productivity Paradox*. Asian-Pacific Economic Cooperation (APEC) Secretariat, Singapore. Available at: https://www.apec.org/Publications/2018/11/APEC-Regional-Trends-Analysis---The-Digital-Productivity-Paradox.

Arbache J (2018). A note on the benefits and challenges of the digital economy for economic development. Contribution by Brazil to the second session of the Intergovernmental Group of Experts on E-Commerce and the Digital Economy. Geneva. Available at: https://unctad.org/meetings/en/Contribution/tdb_ede2018_c14_Brazil_en.pdf.

Ardolino M, Saccani N and Perona M (2016). The rise of platform economy: a framework to describe multisided platforms. XXI Summer School "Francesco Turco" - Industrial Systems Engineering, University of Brescia, Brescia. Available at: http://www.summerschool-aidi.it/edition-2016/cms/extra/papers/final_42.pdf.

Arntz M, Gregory T and Zierahn U (2016). The risk of automation for jobs in OECD countries: A comparative analysis. OECD working papers No. 189. OECD, Paris.

Arrieta A, Peña I, Cruz M, Costa G and Coronel F (2017). Tecnolatinas: Latin America Riding the Technology Tsunami. Inter-American Development Bank, Washington, DC. Available at: https://publications.iadb.org/en/publication/12916/tecnolatinas-latin-america-riding-technology-tsunami.

Arrieta-Ibarra I, Goff L, Jiménez-Hernández D, Lanier J and Weyl EG (2018). Should we treat data as labor? Moving beyond 'free.' *American Economic Association Papers and Proceedings*, 108: 38–42.

Arrington M (2009). US Cyworld will no longer be able to service. *TechCrunch* November 5. Available at: http://social.techcrunch.com/2009/11/05/us-cyworld-will-no-longer-be-able-to-service/.

Artecona R and Chau T (2018). Labour issues in the digital economy. Studies and Perspective Series No.17. Economic Commission for Latin America and the Caribbean (ECLAC), Washington, DC.

ATAF (2019a). The tax challenges arising in Africa from the digitalisation of the economy. African Tax Administration Forum, Pretoria.

ATAF (2019b). Inclusive Framework proposals to address the tax challenges arising in Africa from the digitalisation of the economy. Pretoria.

Athreye SS (2005). The Indian software industry and its evolving service capability. *Industrial and Corporate Change*, 14(3): 393–418.

Atlantic Council (2018). 3D printing: Shaping Africa´s future. Available at: https://www.atlanticcouncil.org/images/publications/3D_Printing_Africa_WEB.pdf.

Australia Competition and Consumer Commission (2018). Digital platforms inquiry. Preliminary report. Competition and Consumer Commission, Canberra.

Autio E, Nambisan S, Thomas LDW and Wright M (2018). Digital affordances, spatial affordances, and the genesis of entrepreneurial ecosystems. *Strategic Entrepreneurship Journal*, 12(1): 72–95.

Autor D (2014). Polanyi's Paradox and the shape of employment growth. Working Paper No. 20485. National Bureau of Economic Research (NBER), Cambridge, MA.

Autor D, Dorn D, Katz LF, Patterson C and Van Reenen J (2017). The fall of the labor share and the rise of superstar firms. Working Paper No. 23396. NBER, Cambridge, MA.

Avi-Yonah R and Tinhaga ZP (2019). Unitary Taxation and International Tax Rules. Working Paper 26. The International Centre for Tax and Development., Brighton.

Avle S (2014). Articulating and enacting development: Skilled returnees in Ghana's ICT Industry. *Information Technologies & International Development*, 10(4): 1–13.

Avle S and Lindtner S (2016). Design(ing) "here" and "there": Tech entrepreneurs, global markets, and reflexivity in design processes. In: Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems: 2233–2245. The Association for Computing Machinery (ACM), New York, NY.

Baldwin C and Woodard CJ (2009). The architecture of platforms: A unified view. In: Gawer A, ed. *Platforms, Markets and Innovation.* Edward Elgar Publishing Limited, Cheltenham: 19–44.

Balliester T and Elsheikhi A (2018). The future of work: A literature review. Working Paper no. 29, ILO Research Department, Geneva.

Banco Central de Costa Rica (2019). Costa Rica: Exportaciones de servicios mediante redes de tecnología, información y comunicación (TIC). Available at: https://activos.bccr.fi.cr/sitios/bccr/proyectocambioannyobase/DocProyectoCambioAnnyoBase/documentoscnadocpresentaciones/CR-Exportaciones-Servicios-Mediante-TIC-2017.pdf.

Banga K and Willem D (2018). Digitalisation and the future of manufacturing in Africa. Overseas Development Institute, London.

Bangladesh Bureau of Statistics (2015). Economic Census 2013. Dhaka.

Bangladesh Computer Council, Tholons (2016). Strategy and roadmap of BCC for strengthening IT/ITES industry of Bangladesh. Dhaka. Available at: https://databd.co/resources/strategy-road-map-of-bcc-for-strengthening-it-ites-industry-of-bangladesh.

Barefoot K, Curtis D, Jolliff W, Nicholson JR, and Omohundro R (2018). Defining and measuring the digital economy. Working paper. Bureau of Economic Analysis, United States Department of Commerce, Washington, DC. Available at: https://www.bea.gov/system/files/papers/WP2018-4.pdf.

Barrera E, Ramon B, Cecconi C, Garneau MB and Murphy J (2018). Measurement challenges of the digital economy. Voorburg Group, Rome, 24–28 Sept. Available at: https://www.istat.it/it/files//2018/03/25SEP.Erika_.Barrera.ChallengesDigitalEconomy-1.pdf.

BASIS (2018). IT and ITES industry overview 2018. Bangladesh Association of Software and Information Services. Available at: https://basis.org.bd/publication/ba96136a3b168568073f9800e5b0f5b9.pdf

Bauer JM (2018). The Internet and income inequality: Socio-economic challenges in a hyperconnected society. *Telecommunications Policy*, 42(4), 333–343.

Bauer M, Lee-Makiyama H, van der Marel E and Verschelde B (2014). The costs of data localisation: Friendly fire on economic recovery. European Centre for International Political Economy, Brussels.

Baumann O, Bergenholtz C, Frederiksen L, Grant RM, Köhler R, Preston DL and Shane S (2018). Rocket Internet: Organizing a startup factory. *Journal of Organization Design,* 7(1): 13.

Bayen M and Giuliani D (2018). 1000 tech hubs are powering ecosystems in Asia Pacific and Africa. Available at: https://www.gsma.com/mobilefordevelopment/programme/ecosystem-accelerator/1000-tech-hubs-are-powering-ecosystems-in-asia-pacific-and-africa.

BEA (2019). Measuring the digital economy: An update incorporating data from the 2018 comprehensive update of the industry economic accounts. Bureau of Economic Analysis, Washington, DC.

Beauvisage T (2017). Selling one's behavioral data: An impossible market? (Research blog). Orange. April 18. Available at: https://recherche.orange.com/en/selling-ones-behavioral-data-an-impossible-market/.

Beckman C, Eisenhardt K, Kotha S, Meyer A and Rajagopalan, N (2012). Technology entrepreneurship. *Strategic Entrepreneurship Journal*, 6(2): 89–93.

Beerepoot N and Keijser C (2014). The service outsourcing sector as driver of development: The expectations of Ghana's ICT for accelerated development programme – Ghana's ICT for Accelerated Development Programme. *Tijdschrift Voor Economische En Sociale Geografie*, 106(5): 556–569.

BEPS Monitoring Group (2017). Tax challenges of the digital economy. Submission in response to the request for comments by the OECD in connection with the work of the Task Force on the Digital Economy, in preparing a report for the G20. Available at: https://bepsmonitoringgroup.wordpress.com/2017/10/18/tax-challenges-of-the-digital-economy/.

Berg J, Furrer M, Harmon E, Rani U and Silberman MS (2018). *Digital Labour Platforms and the Future of Work: Towards Decent Work in the Online World*. International Labour Organisation, Geneva.

Bertulfo DJ, Gentile E and de Vries GJ (2019). The employment effects of technological innovation, consumption, and participation in global value chains: Evidence from developing Asia. Asian Development Bank, Manila.

Bessen J (2017). Information technology and industry concentration. Law & Economics Paper No. 17-41. Boston University School of Law, Boston, MA.

Bieliński T (2018). Competition between Chinese and United States companies in the Internet market. *Interdisciplinary Political and Cultural Journal*, 22(1)1: 137–152.

Bischof ZS, Fontugne R and Bustamante FE (2018). Untangling the world-wide mesh of undersea cables. Proceedings of the 17th ACM Workshop on Hot Topics in Networks HotNets-XVII, November 15–16, 2018, Redmond, WA: 78–84. Available at: https://www.iij-ii.co.jp/en/members/romain/pdf/zach_hotnets2018.pdf.

Boateng R., Budu J, Mbrokoh AS, Boateng SL and Anderson AB (2017). Digital Enterprises in Africa. Paper no. 2. Development Implications of Digital Economies strategic research network. Centre for Development Informatics, University of Manchester. Available at: https://diodeweb.files.wordpress.com/2017/04/diode-paper-2-digital-enterprises-in-africa.pdf.

Boudreau K (2010). Open platform strategies and innovation: Granting access vs. devolving control. *Management Science*, 56(10): 1849–1872.

Brennen S and Kreiss D (2014). Digitalization and digitization. *Culture Digitally*, 8. Available at: http://culturedigitally.org/2014/09/digitalization-and-digitization/.

Bresnahan TF and Trajtenberg M (1995). General purpose technologies: 'Engines of growth'? *Journal of Econometrics,* 65(1): 83–108.

Broadband Commission (2018). Working Group Report on Digital Entrepreneurship. Broadband Commission for Sustainable Development, ITU and UNESCO, Geneva. Available at: https://www.broadbandcommission.org/workinggroups/Pages/Digital-Entrepreneurship.aspx.

Brussevich M, Dabla-Norris E and Khalid S (2019). Is technology widening the gender gap? Automation and the future of female employment. IMF Working Paper No. 19/91. IMF, Washington, DC.

Brussevich M, Dabla-Norris E, Kamunge C, Karnane P, Khalid S and Kochhar K (2018). Gender, technology, and the future of work. Staff Discussion Notes 18/07. IMF, Washington, DC.

Brynjolfsson E (1993). The productivity paradox of information technology. *Communications of the ACM*, 36(12): 66–77.

Brynjolfsson E and Kahin, B, eds. (2002). *Understanding the Digital Economy*. Massachusetts Institute of Technology, Cambridge, MA.

Brynjolfsson E, Diewert WE, Collis A, Eggers F and Fox KJ (2019). GDP-B: Accounting for the value of new and free goods in the digital economy. Available at: http://ide.mit.edu/sites/default/files/publications/SSRN-id3356697%20gdp2.pdf.

Bukht R and Heeks R (2017). Defining, conceptualising and measuring the digital economy. GDI Development Informatics Working Papers, no. 68. University of Manchester, Manchester.

Bukht R. and Heeks R (2018). Digital economy policy in developing countries, DIODE Working Papers, 7. University of Manchester, Manchester.

Bunn D (2018). A wave of digital taxation. (Blog). Tax Foundation, New York, NY. Available at: https://taxfoundation.org/digital-taxation-wave/.

Burri M (2016). The World Trade Organization as an actor in global Internet governance. SSRN Scholarly Paper No. ID 2792219, Social Science Research Network, Rochester, NY.

Burri M (2017). The regulation of data flows through trade agreements. *Georgetown Journal of International Law*, 48: 407–448.

CAF (2017). Hacia la transformación digital de América Latina y el Caribe: El Observatorio CAF del Ecosistema Digital. Development Bank of Latin America, Caracas. Available at: http://scioteca.caf.com/handle/123456789/1059.

Capdevila I (2013). Knowledge dynamics in localized communities: Coworking spaces as microclusters. *SSRN Electronic Journal*, at: https://doi.org/10.2139/ssrn.2414121.

Caribou Digital (2016). Winners and losers in the global app economy. Caribou Digital Publishing, Farnham, Surrey.

Caribou Digital (2017). Paying attention to the poor: Digital advertising in emerging markets. Caribou Digital Publishing, Farnham, Surrey.

Carnahan M (2015). Taxation challenges in developing countries. *Asia & the Pacific Policy Studies*, 2(1): 169–82.

Carree MA and Thurik AR (2003). The impact of entrepreneurship on economic growth. In: Acs ZJ and Audretsch DB, eds. *Handbook of Entrepreneurship Research*. Springer; New York, NY: 437–471.

Castro D and McQuinn A (2015). Cross-border data flows enable growth in all industries. Information Technology and Innovation Foundation, Washington, DC.

CBInsights (2018). Android of the auto industry? How Baidu may race ahead of Google, Tesla, and others in autonomous vehicles. Available at: https://www.cbinsights.com/research/baidu-china-autonomous-vehicles/.

Chander A and Lê UP (2015). Data nationalism. *Emory Law Journal*, 3(64): 677–739.

Chen A, Feamster N and Calandro E (2017). Exploring the walled garden theory: An empirical framework to assess pricing effects on mobile data usage. *Telecommunications Policy*, 41(7): 587–599.

Chen MX and Wu M (2016). The value of reputation in trade: Evidence from Alibaba. IIEP Paper (IIEP–WP–2016–20). George Washington University, Washington, DC.

Choudary SP (2018). The architecture of digital labour platforms: Policy recommendations on platform design for worker well-being. ILO Research Paper Series. ILO, Geneva.

CIGI-Ipsos, UNCTAD and Internet Society (2019). 2019 CIGI-Ipsos Global Survey on Internet Security and Trust. Centre for International Governance Innovation, UNCTAD and the Internet Society. Available at: https://www.cigionline.org/internet-survey-2019.

Cisco (2018a). Cisco Global Cloud Index: Forecast and methodology, 2016–2021. White Paper. Available at: https://www.cisco.com/c/en/us/solutions/collateral/service-provider/global-cloud-index-gci/white-paper-c11-738085.html.

Cisco (2018b). Cisco Visual Networking Index: Forecast and trends, 2017-2022. Available at: https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/white-paper-c11-741490.pdf.

Ciuriak D (2018). The digital transformation and the transformation of international trade. RTA Exchange. International Centre for Trade and Sustainable Development (ICTSD), Geneva, and the Inter-American Development Bank (IDB), Washington, DC.

Coe NM and Yeung HW (2015). *Global Production Networks: Theorizing Economic Development in an Interconnected World*. Oxford University Press, Oxford.

COFECE (2018). Repensar la competencia en la economia digital. Estudios de promoción de la competencia. Comisión Federal de Competencia Económica, Mexico City.

Collela P (2017). 5G and IoT: Ushering in a new era. Ericsson. Available at: https://www.ericsson.com/en/about-us/india/authored-articles/5g-and-iot-ushering-in-a-new-era.

Collon C (2017). VC funding raised by African tech startups totals record-breaking US$ 366.8 million in 2016 (28 February). *Linkedin.* Available at: https://www.linkedin.com/pulse/vc-funding-raised-african-tech-startups-totals-record-cyril-collon/?lipi=urn%3Ali%3Apage%3Ad_flagship3_pulse_read%3BgHRr%2FIRUSYGhfX2%2BrACaAQ%3D%3D&licu=urn%3Ali%3Acontrol%3Ad_flagship3_pulse_read-related.

Collon C (2018). In another record-breaking year, African tech start-ups raised US$ 560 Million in VC funding in 2017, a 53% YoY growth. (20 February). Available at: https://www.linkedin.com/pulse/another-record-breaking-year-african-tech-start-ups-raised-collon/?trackingId=6ncsYxVelpYLqWvU8n6CNg%3D%3D .

Copenhagen Economics (2018). European data centres: How Google's digital infrastructure investment is supporting sustainable growth in Europe. Available at: https://www.copenhageneconomics.com/publications/publication/european-data-centres.

Cory N (2017). Cross-border data flows: Where are the barriers, and what do they cost? Information Technology and Innovation Foundation, Washington, DC. Available at: http://www2.itif.org/2017-cross-border-data-flows.pdf.

Cosenza V (2018). World map of social networks. (Vincos blog). Available at: http://vincos.it/world-map-of-social-networks/.

Couldry N and Mejias UA (2018). Data colonialism: Rethinking big data's relation to the contemporary subject. *Television & New Media*. Available at: https://doi.org/10.1177/1527476418796632.

Coyle D (2018). Practical competition policy implications of digital platforms. Bennett Institute for Public Policy working paper no: 01/2018. University of Cambridge, Cambridge.

Crafts N (2018). The productivity slowdown: Is it the 'new normal'? *Oxford Review of Economic Policy*, 34(3): 443–460.

Crosby D (2016). Analysis of data localization measures under WTO services trade rules and commitments. E15 Policy Brief. International Centre for Trade and Sustainable Development (ICTSD) and World Economic Forum, Geneva.

Crouch H (2018). GP at hand-like service in Rwanda surpasses 2 million members. *Digital Health*, 10 May. Available at: https://www.digitalhealth.net/2018/05/gp-at-hand-like-service-in-rwana-surpasses-2-million-members/.

Cusumano MA and Gawer A (2002). The elements of platform leadership. *MIT Sloan Management Review*, 43(3): 51–58.

Dahlman C, Mealy S and Wermelinger M (2016). *Harnessing the Digital Economy for Developing Countries.* OECD Publishing, Paris.

Dalkir K (2005). *Knowledge Management in Theory and Practice*. Routledge, London.

Das M and Hilgenstock B (2018). The exposure to routinization: Labor market implications for developed and developing economies. Working Paper No. 18/135. IMF, Washington, DC.

Davenport TH and Prusak L (1998). *Working Knowledge: How Organizations Manage What They Know*. Harvard Business Press, Cambridge, MA.

David-West O and Evans P (2015). The rise of African platforms: A regional survey. Center for Global Enterprise, New York, NY.

De Stefano V and Wouters M (2019). Should digital labour platforms be treated as private employment agencies? Foresight Briefs. European Trade Union Institute (ETUI), Brussels.

Delautre G (2017). The distribution of value added among firms and countries: The case of the ICT manufacturing sector. ILO Research Department Working Paper 16. International Labour Office, Geneva.

Deloitte (2019). 5G: The new network arrives. Technology, Media and Telecommunications Predictions 2019. Available at: https://www2.deloitte.com/insights/us/en/industry/technology/technology-media-and-telecom-predictions/5g-wireless-technology-market.html.

DGCIS (2018). India's export of ICT-enabled services: An all India survey: 2016-17. Directorate General of Commercial Intelligence and Statistics, Ministry of Commerce and Industry, Government of India, New Delhi. June. Available at: http://dgciskol.gov.in/Writereaddata/Downloads/IctExportReport.pdf.

DIODE (2018). Digital Economy Policy in Developing Countries. Strategy Brief. Development Implications of Digital Economies. Manchester.

Disrupt Africa (2016). The Disrupt Africa African Tech Startups Funding Report 2015. Available at: https://gumroad.com/l/egbOX.

Disrupt Africa (2017). The Disrupt Africa African Tech Startups Funding Report 2016. Available at: https://gumroad.com/l/AHAPM.

Disrupt Africa (2018). Funding Report 2017. Available at: http://disrupt-africa.com/funding-report/.

Dixon H (2018). Regulate to liberate: Can Europe save the Internet. *Foreign Affairs*, 97(5): 28–32.

Dong JQ and Wu W (2015). Business value of social media technologies: Evidence from online user innovation communities. *The Journal of Strategic Information Systems*, 24(2): 113–127.

Donner J (2018). A vision of digital development in 2028. Paper presented at the USAID Digital Development Forum, Washington, DC, 9 March. Available at: https://medium.com/caribou-digital/a-vision-of-digital-development-in-2028-43c8ff3c69e.

Drake WJ, Cerf VG and Kleinwächter W (2016). Internet fragmentation: An overview. World Economic Forum, Geneva.

Dutch Transformation Forum (2018). Unlocking the value of the platform economy: Mastering the good, the bad and the ugly. Available at: https://dutchitchannel.nl/612528/dutch-transformation-platform-economy-paper-kpmg.pdf.

Dutz MA, Almeida RK and Packard TG (2018). The jobs of tomorrow: Technology, productivity, and prosperity in Latin America and the Caribbean. Report no. 125044. World Bank, Washington, DC.

eBay (2013). Commerce 3.0 for development: The promise of the Global Empowerment Network. San Francisco, CA. Available at: https://www.ebaymainstreet.com/sites/default/files/eBay_Commerce-3-for-Development.pdf.

ECLAC (2018). Data, algorithms and policies. Redefining the digital world. Economic Commission for Latin America and the Caribbean. LC/CMSI.6/4. Santiago.

ECLAC (2019). Fiscal panorama of Latin America and the Caribbean 2019. Tax policies for resource mobilization in the framework of the 2030 Agenda for Sustainable Development. LC/PUB.2019/8-P. Santiago.

Eichhorst W (2017). Labor market institutions and the future of work: Good jobs for all? IZA Policy Paper No. 122. Institute of Labour Economics, Bonn.

eMarketer (2019a). Digital Ad Spending 2019. Global. Available at: https://www.emarketer.com/content/global-digital-ad-spending-2019.

eMarketer (2019b. Digital Ad Spending 2019. US. Available at: https://www.emarketer.com/content/us-digital-ad-spending-2019.

Equals Research Group (2019). Taking stock: Data and evidence on gender equality in digital access, skills and leadership. Available at: https://www.equals.org/single-post/2019/03/15/New-EQUALS-Research-Group-report-unveils-persistent-digital-gaps-and-the-complexity-of-gender-equality-in-ICT-access-skills-and-leadership.

Ericsson (2018). Mobility report. Available at: https://www.ericsson.com/assets/local/mobility-report/documents/2018/ericsson-mobility-report-november-2018.pdf.

Eurofound (2018a). Automation, digitisation and platforms: Implications for work and employment. Research report. European Foundation for the Improvement of Living and Working Conditions. Publications Office of the European Union, Luxembourg.

Eurofound (2018b). Platform work: Types and implications for work and employment–Literature review. Publications Office of the European Union, Luxembourg.

European Commission (2016). Synopsis report on the public consultation on the regulatory environment for platforms, online intermediaries and the collaborative economy. Available at: https://ec.europa.eu/digital-single-market/en/news/full-report-results-public-consultation-regulatory-environment-platforms-online-intermediaries.

European Commission (2018). Platform workers in Europe: Evidence from the COLLEEM Survey. Technical report (Authors: Pesole A, Urzi Brancati MC, Fernández-Macías E, Biagi F and González Vázquez I). Publications Office of the European Union, Luxembourg.

European Parliament (2018a). Fair taxation of the digital economy. Brussels. Available at: http://www.europarl.europa.eu/thinktank/en/document.html?reference=EPRS_ATA(2018)630327.

European Parliament (2018b). The social protection of workers in the platform economy. Brussels. Available at : http://www.europarl.europa.eu/thinktank/en/document.html?reference=IPOL_STU(2017)614184.

Evans J (2005). Koreans find secret cybersauce. *Wired,* 8 August. Available at: https://www.wired.com/2005/08/koreans-find-secret-cybersauce/.

Evans P (2016). The rise of Asian platforms: A regional survey. The Centre for Global Enterprise, New York, NY.

Evans DS and Schmalensee R (2010). Failure to launch: Critical mass in platform businesses. *Review of Network Economics*, 9(4): 1–8.

Evans P and Gawer A (2016). The rise of the platform enterprise: A global survey. The Emerging Platform Economy Series, 1. The Centre for Global Enterprise, New York, NY.

Fabo B, Beblavý M, Kilhoffer Z and Lenaerts K (2017). An overview of European Platforms: Scope and business models. JRC Science for Policy Report. European Commission, Luxembourg.

Facebook (2018). Form 10-Q. Available at: https://d18rn0p25nwr6d.cloudfront.net/CIK-0001326801/5c47f19c-2021-4e36-89cc-4bc0bb765b51.pdf.

Faravelon A, Frénot S and Grumbach S (2016). Chasing data in the intermediation era: Economy and security at stake. *IEEE Security Privacy,* 14 (3): 22–31.

Farrell J and Klemperer P (2007). Coordination and lock-in: Competition with switching costs and network effects. In: Armstrong M and Porter R, eds. *Handbook of Industrial Organization,* Volume 3. Elsevier (North Holland Publishing Co), Duivendrecht: 1967–2072.

Ferracane M (2017). Restrictions on cross-border data flows: A taxonomy. Working Paper No. 1. European Centre for International Political Economy, Brussels.

Fichman RG, Dos Santos BL and Zheng ZE (2014). Digital innovation as a fundamental and powerful concept in the information systems curriculum. *MIS Quarterly*, 38(2): 329–343.

Firestone R and Kelly T (2016). The importance of mapping tech hubs in Africa, and beyond. (Blog, 24 August). Available at: http://blogs.worldbank.org/ic4d/importance-mapping-tech-hubs-africa-and-beyond.

Florito J, Aneja U and Beneke de Sanfeliu M (2018). Gender, economic equity and the future of work: A future of work that works for women. Policy brief. CARI (Consejo Argentino para las Relaciones Internacionales), Buenos Aires.

Flutterwave (2018). Flutterwave completes Series A Extension round of financing, former VISA Chairman and CEO joins Board. (Blog, 14 October). Available at: https://flutterwave.com/blog/flutterwave-completes-series-a-extension-round-of-financing-former-visa-chairman-and-ceo-joins-board/ .

Fold N (2001). Restructuring of the European chocolate industry and its impact on cocoa production in West Africa. *Journal of Economic Geography*, 1(4): 405–420.

Foster C (2014). Does quality matter for innovations in low income markets? The case of the Kenyan mobile phone sector. *Technology in Society*, 38: 119–129.

Foster C (2017). The rise of the micro-multinational? Small enterprises and digital platform engagement in emerging economies. Paper presented at SASE 2017 (Society for the Advancement of Socio-Economics), Lyon, 27 June.

Foster C and Graham M (2017). Reconsidering the role of the digital in global production networks. *Global Networks*, 17(1): 66–88.

Foster C, Graham M, Mann L, Waema T and Friederici N (2018). Digital control in value chains: Challenges of connectivity for East African firms. *Economic Geography*, 94(1): 68–86.

Freddi D (2017). The employment effects of digitalization: A literature review. Claudio Sabbatini Foundation. Available at : http://www.fondazionesabattini.it/pages/ricerca-europea-industria-4-0.

Frey CB and Osborne MA (2013). The future of employment: How susceptible are jobs to computerisation? University of Oxford, Oxford.

Frey CB and Rahbari E (2016). Do labor-saving technologies spell the death of jobs in the developing world? In: Chandy E, ed. *The Future of Work in the Developing World*. Brookings Institution, Washington, DC.

Friederici N (2014). The business models of mLabs and mHubs: An evaluation of infoDev's mobile innovation support pilots. infoDev, supported by World Bank Group, Washington, DC. Available at: http://www.infodev.org/mobilebusinessmodels.

Friederici N (2017). Innovation hubs in Africa: Assemblers of technology entrepreneurs (DPhil. thesis). Oxford Internet Institute, University of Oxford, Oxford.

Friederici N (2018a). Grounding the dream of African innovation hubs: Two cases in Kigali. *Journal of Developmental Entrepreneurship*, 23(2): 1–22.

Friederici N (2018b). Hope and hype in Africa's digital economy: The rise of innovation hubs. In: Graham M. ed. *Digital Economies at Global Margins*. MIT Press, Cambridge, MA: 193–222.

Friederici N and Graham M (2018). The bounded opportunities of digital enterprises in global economic peripheries Social Science Research Network Scholarly Paper No. ID 3249499. Rochester, NY.

Friederici N, Wahome M and Graham M (forthcoming). *Digital Entrepreneurship in Africa.* Available at: https://geonet.oii.ox.ac.uk/blog/digital-entrepreneurship-in-africa-announcing-our-upcoming-book/friederici-et-al_outline_digital-entrep-africa-nov-2018/.

G20 DETF (2018). Toolkit for measuring the digital economy. G20 Digital Economy Task Force. Available at: http://www.oecd.org/g20/summits/buenos-aires/G20-Toolkit-for-measuring-digital-economy.pdf.

G-24 (2019). Proposal for addressing tax challenges arising from digitalization. G-24 Working Group on Tax Policy and International Tax Cooperation. Available at: https://www.g24.org/wp-content/uploads/2019/03/G-24_proposal_for_Taxation_of_Digital_Economy_Jan17_Special_Session_2.pdf .

Gallagher B (2018). Copycat: How Facebook tried to squash Snapchat. *Wired*, 16 February.

Galperin H and Fernanda Viecens M (2017). Connected for development? Theory and evidence about the impact of Internet technologies on poverty alleviation. *Development Policy Review*, 35(3): 315–336.

Gao LS and Iyer B (2006). Analyzing complementarities using software stacks for software industry acquisitions. *Journal of Management Information Systems*, 23(2): 119–147.

Gawer A (2009). Platform dynamics and strategies: From products to services. In: Gawer A, ed. *Platforms, Markets and Innovation*. Edward Elgar Publishing Limited, Cheltenham: 45–76.

Gawer A (2014). Bridging differing perspectives on technological platforms: Toward an integrative framework. *Research Policy*, 43(7): 1239–1249.

Gawer A and Cusumano MA (2002). *Platform Leadership: How Intel, Microsoft, and Cisco Drive Industry Innovation*. Harvard Business School Publishing, Boston, MA.

Gawer A and Cusumano MA (2014). Industry platforms and ecosystem innovation. *Journal of Product Innovation Management*, 31(3): 417–433.

Gereffi G (1994). The organization of buyer-driven global commodity chains: How US retailers shape overseas production networks. In: Gereffi G and Korzeniewicz M, eds. *Commodity Chains and Global Capitalism*. Praeger, Westport, CT: 95–122.

Gereffi G, Humphrey J and Sturgeon T (2005). The governance of global value chains. *Review of International Political Economy*, 12(1): 78–104.

Ghedin G (2013). Social media in South Korea: How Facebook won Cyworld. Digital in the Round. (Blog, 4 April). Available at: http://www.digitalintheround.com/south-korea-cyworld-facebook/.

Gimein M (2000). Meet the dumbest dot-com in the world. *Fortune*, 10 July.

Goodwin T (2015). The battle is for the customer interface. *TechCrunch* (blog, 3 March). Available at: http://social.techcrunch.com/2015/03/03/in-the-age-of-disintermediation-the-battle-is-all-for-the-customer-interface/.

Google (2010). Enabling trade in the era of information technologies: Breaking down barriers to the free flow of information. Google, Mountain View, CA. Available at : https://static.googleusercontent.com/media/www.google.com/en//googleblogs/pdfs/trade_free_flow_of_information.pdf.

Google and Temasek (2016). E-conomy SEA. Available at: https://www.thinkwithgoogle.com/intl/en-apac/trends-and-insights/e-conomy-sea-unlocking-200b-digital-opportunity.

Gordon RJ (2016). *The Rise and Fall of American Growth: The U.S. Standard of Living Since the Civil War*. Princeton University Press, Princeton, NJ.

Graef I (2015). Market definition and market power in data: The case of online platforms. *World Competition: Law and Economics Review*, 38(4): 473–506.

Graef I (2018). When data evolves into market power: Data concentration and data abuse under competition law. In: Moore M and Tambini D, eds. *Digital Dominance: The Power of Google, Amazon, Facebook, and Apple*. Oxford University Press, Oxford: 71–97.

Graham M, ed. (2018a). *Digital Economies at Global Margins*. MIT Press, Cambridge, MA.

Graham T (2018b). Platforms and hyper-choice on the World Wide Web. *Big Data & Society*, 5(1): 1–14.

Graham T (2018c). Barcelona is leading the fightback against smart city surveillance. *Wired* UK, May 18. Available at: https://www.wired.co.uk/article/barcelona-decidim-ada-colau-francesca-bria-decode.

Graham M and Mann L (2013). Imagining a Silicon savannah? Technological and conceptual connectivity in Kenya's BPO and software development sectors. *The Electronic Journal of Information Systems in Developing Countries*, 56(2): 1–19.

Graham M, Hjorth I and Lehdonvirta V (2017). Digital labour and development: Impacts of global digital labour platforms and the gig economy on worker livelihoods. *Transfer: European Review of Labour and Research*, 23(2): 135–162.

Greengard S (2010). Cloud computing and developing nations. *Communications of the ACM*, 53(5): 18.

Grimm AN (2016). Trends in U.S. trade in information and communications technology (ICT) services and in ICT-enabled services. *Survey of Current Business,* May.

Gryszkiewicz L, Lykourentzou I and Toivonen T (2017). Innovation labs: Leveraging openness for radical innovation? *Journal of Innovation Management*, 4(4): 68–97.

GSMA (2018). The data value chain. Available at: https://www.gsma.com/publicpolicy/wp-content/uploads/2018/07/GSMA_Data_Value_Chain_June_2018.pdf.

GSMA (2019). The mobile economy 2019. Available at: https://www.gsmaintelligence.com/research/?file=b9a6e6202ee1d5f787cfebb95d3639c5&download.

Hadzhieva E (2019). Impact of digitalisation on international tax matters: Challenges and remedies. Study for the Committee on Financial Crimes, Tax Evasion and Tax Avoidance, Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament, Luxembourg.

Hall W and Pesenti J (2017). Growing the artificial intelligence industry in the UK. Government of the United Kingdom, London. Available at: https://www.gov.uk/government/publications/growing-the-artificial-intelligence-industry-in-the-uk.

Hallward-Driemeier M and Nayyar G (2018). *Trouble in the Making? The Future of Manufacturing-Led Development*. World Bank, Washington, DC.

Hao K (2018). Alibaba is trying to reinvent China's mom-and-pop stores. *Quartz*, 5 January. Available at: https://qz.com/1171743/alibaba-is-trying-to-reinvent-chinas-mom-and-pop-stores/.

Harbour PJ and Koslov TI (2010). Section 2 in a Web 2.0 world: An expanded vision of relevant product markets. *Antitrust Law Journal*, 76(3): 769–797.

Hardinges J (2018). What is a data trust? (Blog, 10 July). Open Data Institute Available at: https://theodi.org/article/what-is-a-data-trust/.

Hargittai E (2002). Second-level digital divide: Differences in people's online skills. *First Monday*, 7(4). 1 April. Available at: http://www.eszter.com/research/pubs/hargittai-secondleveldd.pdf.

Haskel J and Westlake S (2018). *Capitalism Without Capital: The Rise of the Intangible Economy*. Princeton University Press, Princeton and Oxford.

Heeks R and Arun S (2010). Social outsourcing as a development tool: The impact of outsourcing IT services to women's social enterprises in Kerala. *Journal of International Development*, 22(4): 441–454.

Hegewisch A, Childers C and Hartmann H (2019). Women, automation, and the future of work. Institute for Women's Policy Research, Washington, DC.

Henderson J, Dicken P, Hess M, Coe N and Yeung HW-C (2002). Global production networks and the analysis of economic development. *Review of International Political Economy*, 9(3): 436–464.

Henfridsson O and Bygstad B (2013). The generative mechanisms of digital infrastructure evolution. *Management Information Systems Quarterly*, 37(3): 896–931.

Henfridsson O, Yoo Y and Svahn F (2009). Path creation in digital innovation: A multi-layered dialectics perspective. Association for Information Systems, Atlanta, GA.

Hinson R (2010). The value chain and e-business in exporting: Case studies from Ghana's non-traditional export (NTE) sector. *Telematics and Informatics*, 27(3): 323–340.

HoC (2016). The digital economy. House of Commons Business, Innovation and Skills Committee, London.

Holland CP and Gutiérrez-Leefmans M (2018). A taxonomy of SME e-commerce platforms derived from a market-level analysis. *International Journal of Electronic Commerce*, 22(2): 161–201.

Howard PN (2018). Our data, ourselves. *Foreign Policy*, 16 July. Available at: https://foreignpolicy.com/2018/07/16/our-data-ourselves-democracy-technology-algorithms/.

Howell S (2018). Big data and monopolization. Social Science Research Network. Rochester, NY. Available at: https://papers.ssrn.com/abstract=3123976.

HP and AT Kearney (2018). 3D printing: Ensuring manufacturing leadership in the 21st century. Available at: http://www.ncsl.org/Portals/1/Documents/fsl/3D_Printing_24659.pdf.

Huawei (2018). Annual Report 2017. Available at: https://www.huawei.com/en/press-events/annual-report.

Huawei and Oxford Economics (2017). Digital spillover: Measuring the true impact of the digital economy. Available at: https://www.huawei.com/minisite/gci/en/digital-spillover/index.html.

Hufbauer GC and Kim J (2008). International competition policy and the WTO. Paper presented at the conference titled One Year Later: The Antitrust Modernization Commission's Report and the Challenges that Await Antitrust, New York University, 11 April. Available at: https://piie.com/commentary/speeches-papers/international-competition-policy-and-wto.

IAS Parliament (2019). Target 2019: Government Schemes I. Shankar IAS Academy, Chennai. Available at: http://www.iasparliament.com/uploads/downloads/Target_2019_Government_Schemes_www.iasparliament.com7.pdf.

ICRICT (2019). The fight against tax avoidance. BEPS 2.0: What the OECD BEPS Process has achieved and what real reform should look like. Media Advisory. Independent Commission for the Reform of International Corporate Taxation, Chesham. Available at: https://static1.squarespace.com/static/5a0c602bf43b5594845abb81/t/5c409080898583797a65acac/1547735168762/media_advisory_thefightagainsttaxavoidance.pdf.

IDC (2016). European Data Market SMART 2013/0063: D8 – Second Interim Report. International Data Corporation. Farmingham, MA. Available at: https://docplayer.net/63151960-European-data-market-smart-2013-0063-d8-second-interim-report.html.

IDC (2018). Data Age 2025: The digitization of the world – From edge to core. White paper. Farmingham, MA. Available at: https://www.seagate.com/files/www-content/our-story/trends/files/idc-seagate-dataage-whitepaper.pdf.

IDC (2019). IDC forecasts worldwide spending on the internet of things to reach $745 million in 2019, led by the manufacturing, consumer, transportation, and utilities sectors. Farmingham, MA. Available at: https://www.idc.com/getdoc.jsp?containerId=prUS44596319.

IDC and Lisbon Council (2018). First report on facts and figures. Updating the European Data Market Study Monitoring Tool. Farmingham, MA.

IDRC (2018). The future of work in the global South. International Development Research Centre, Ottawa. Available at: https://fowigs.net/wp-content/uploads/2018/10/FutureOfWorkintheGlobalSouth.pdf.

IFDC (2015). Sorghum soars in Kenya. (International Fertilizer Development Centre Blog). Available at: https://ifdc.org/sorghum-soars-in-kenya/.

ILO (2015). *The Future of Work Centenary Initiative*. Report 1 of the ILO Director General to the International Labour Conference, 104th Session, Geneva. ILC.104/DG/I. Geneva.

ILO (2018). The impact of technology on the quality and quantity of jobs. Issue Brief No. 6. Prepared for the 2nd Meeting of the Global Commission on the Future of Work, Geneva, 15–17 February.

ILO (2019). *Work for a Brighter Future*. Global Commission on the Future of Work. Geneva.

IMF (2018). Measuring the digital economy. IMF Policy Paper. Washington, DC. Available at: https://www.imf.org/en/Publications/Policy-Papers/Issues/2018/04/03/022818-measuring-the-digital-economy.

IMF (2019a). *World Economic Outlook,* Spring 2019. Washington, DC.

IMF (2019b). China's digital economy: Opportunities and risks. Working Paper No. 19/16. Washington, DC.

IMF (2019c). Corporate taxation in the global economy. Policy Paper No. 19/007. Washington, DC. Available at: https://www.imf.org/en/Publications/Policy-Papers/Issues/2019/03/08/Corporate-Taxation-in-the-Global-Economy-46650.

Insight2Impact (2019). Africa's digital platforms and financial services: An eight-country overview. March. Available at: https://i2ifacility.org/system/documents/files/000/000/086/original/DIGITAL_ADP_Focus_Note.pdf?1553833148.

International Chamber of Commerce (2016). Trade in the digital economy: A primer on global data flows for policymakers. International Chamber of Commerce, Paris. Available at: https://iccwbo.org/publication/trade-in-the-digital-economy/.

International Federation of Robotics (2018). *World Robotics Report 2018*. Frankfurt. Available at: https://ifr.org/ifr-press-releases/news/global-industrial-robot-sales-doubled-over-the-past-five-years.

Internet Association (2017). Modernizing NAFTA for today's economy. Washington, DC. Available at: https://internetassociation.org/wp-content/uploads/2017/06/Modernizing-NAFTA-White-Paper.pdf.

Internet Society (2019). *2019 Internet Society Global Internet Report: Consolidation in the Internet Economy*. Geneva. Available at: https://future.internetsociety.org/2019/wp-content/uploads/sites/2/2019/04/InternetSociety-GlobalInternetReport-ConsolidationintheInternetEconomy.pdf.

IoT Analytics (2018). State of the IoT 2018: Number of IoT devices now at 7B – Market accelerating. Available at https://iot-analytics.com/state-of-the-iot-update-q1-q2-2018-number-of-iot-devices-now-7b/.

IT for Change (2017). Policy frameworks for digital platforms. Background paper. Bengaluru, India.

ITU (2017). *ICT Facts and Figures 2017*. Geneva. Available at: https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2017.pdf.

ITU (2018a). *Setting the Scene for 5G: Opportunities & Challenges*. Geneva.

ITU (2018b). Assessing the economic impact of artificial intelligence. Issue Paper No.1, September. Available at: https://www.itu.int/dms_pub/itu-s/opb/gen/S-GEN-ISSUEPAPER-2018-1-PDF-E.pdf.

ITU (2018c). *ICTs, LDCs and the SDGs: Achieving Universal and Affordable Internet in the LDCs*. Thematic report. In partnership with the United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States (UN-OHRLLS). Geneva. Available at: https://www.itu.int/en/ITU-D/LDCs/Pages/Publications/LDCs/D-LDC-ICTLDC-2018-PDF-E.pdf.

ITU (2018d). *Measuring the Information Society 2018*. Geneva. Available at: https://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2018/MISR-2018-Vol-1-E.pdf.

Jacobson D, ed. (2018). *Corporate Tax and Industrial Policy in Ireland: Selections from Upsetting the Applecart*. TASC, Dublin.

Jaewon K (2017). South Korean antitrust agency moving to control Google, Facebook. *Nikkei Asian Review*, 26 June. Available at: https://asia.nikkei.com/Politics-Economy/Policy-Politics/South-Korean-antitrust-agency-moving-to-control-Google-Facebook.

Ja-young Y (2011). Is homegrown Cyworld giving in to Facebook? *The Korea Times*, 7 October.

Jie S (2018). China exports facial ID technology to Zimbabwe. *Global Times*, 12 April.

Jiménez A and Zheng Y (2017). Tech hubs, innovation and development. *Information Technology for Development*, 24(1): 95–118.

Johnston H and Land-Kazlauskas C (2018). Organizing on-demand: Representation, voice, and collective bargaining in the gig economy. Conditions of Work and Employment Series No. 94. ILO, Geneva.

Jorgenson, DW (2001). Information Technology and the U.S. Economy. *American Economic Review* 91 (1):1–33.

Jorgenson, DW (2011). Innovation and productivity growth. *American Journal of Agricultural Economics*, 93(2): 276–96.

Jovanovic B and Rousseau PL (2005). General purpose technologies. Working Paper No. 11093, NBER, Cambridge, MA.

JP Morgan (2016). Paychecks, paydays, and the online platform economy. Available at: https://www.jpmorganchase.com/corporate/institute/report-paychecks-paydays-and-the-online-platform-economy.htm.

Kapil N, Andjelkovic M and Lu Z (2018). Is acceleration the panacea for scaling growth entrepreneurs? Reflections from XL Africa (World Bank Blogs, 2 February). Available at: https://blogs.worldbank.org/psd/acceleration-panacea-scaling-growth-entrepreneurs-reflections-xl-africa.

Kaplinsky R and Morris M (2001). *A Handbook for Value Chain Research*. International Development Research Centre, Ottawa.

Karippacheril TG, Nikayin F, de Reuver M and Bouwman H (2013). Serving the poor: Multisided mobile service platforms, openness, competition, collaboration and the struggle for leadership. *Telecommunications Policy*, 37(1): 24–34.

Kende M (2015). The mobile app [applications] divide. Discussion Paper No. 1. Internet Society, Geneva.

Kende M (2017). Promoting the African Internet Economy. Internet Society, Geneva.

Kenney M and Zysman J (2016). The rise of the platform economy. *Issues in Science and Technology*, 32(3): 61-69.

Kenney M and Zysman J (2019). Unicorns, Cheshire cats, and the new dilemmas of entrepreneurial finance. *Venture Capital*, 21(1): 35–50.

Khan L (2017). Amazon's antitrust paradox. *Yale Law Journal*, 126(3): 710–805. Available at: https://ssrn.com/abstract=2911742.

Khan L (2018). Amazon: An infrastructure service and its challenge to current antitrust law. In: Moore M and Tambini D, eds. *Digital Dominance: The Power of Google, Amazon, Facebook, and Apple*. Oxford University Press, Oxford: 98–129.

Klemperer P (1987). Markets with consumer switching costs. *The Quarterly Journal of Economics*, 102(2): 375–394.

Knickrehm M, Berthon B and Daugherty P (2016). *Digital Disruption: The Growth Multiplier*. Accenture, Dublin.

Kolbert E (2017). Who owns the Internet? *The New Yorker*, 21 August.

Koskinen K, Bonina C and Eaton B (2018). Digital platforms in the global South. Working paper no. 8. Development Implications of Digital Economies (DIODE) Strategic Research Network, Manchester.

Krchniva K (2014). Comparison of European, Canadian and U.S. formula apportionment on real data. *Procedia Economics and Finance*, 12: 309–318. Elsevier, Amsterdam.

Krishnan V and Gupta S (2001). Appropriateness and impact of platform-based product development. *Management Science*, 47(1): 52–68.

Kumar R (2014). Elusive empowerment: Price information and disintermediation in soybean markets in Malwa, India. *Development and Change*, 45(6): 1332–1360.

Laney D (2001). 3D data management: Controlling data volume, velocity and variety. *META Group Research Note*, 6(70): 1.

Lanier J (2014). *Who Owns the Future*? Penguin, London.

Lawrence M and Laybourn-Langton L (2018). The digital commonwealth: From private enclosure to collective benefit. Institute for Public Policy Research, London.

Lee K-F (2018a). *AI Superpowers: China, Silicon Valley, and the New World Order*. Houghton Mifflin Harcourt, Boston, MA.

Lee D (2018b). Why big tech pays poor Kenyans to programme self-driving cars. *BBC News* 3 November.

Lehdonvirta V, Kässi O, Hjorth I, Barnard H and Graham M (2018). The global platform economy: A new offshoring institution enabling emerging-economy microproviders. *Journal of Management*, 45(2): 359–383.

Lerner J (2009). *Boulevard of Broken Dreams: Why Public Efforts to Boost Entrepreneurship and Venture Capital Have Failed – And What to Do About it*. Princeton University Press, Princeton, NJ.

Leviathan Security Group (2015). Quantifying the cost of forced localization. Seattle.

Li J (2014). Protecting the tax base in the digital economy. Draft paper no. 9. Papers on Selected Topics in Protecting the Tax Base of Developing Countries of the United Nations Department of Economic and Social Affairs, New York, NY.

Li F, Frederick S and Gereffi G (2018). E-commerce and industrial upgrading in the Chinese apparel value chain. *Journal of Contemporary Asia*, 49(1): 24–53.

Limpitlaw J (2019). Human rights impacts of taxing popular Internet services: The cases of Kenya, Tanzania and Uganda. Association of Progressive Communications. Available at: https://www.apc.org/en/pubs/human-rights-impacts-taxing-popular-internet-services-cases-kenya-tanzania-and-uganda.

Littlewood DC and Kiyumbu WL (2018). "Hub" organisations in Kenya: What are they? What do they do? And what is their potential? *Technological Forecasting and Social Change*, 131: 276–285.

Macbride Commission (2003). *Many Voices, One World: Towards a New, More Just, and More Efficient World Information and Communication Order*. Rowman & Littlefield Publishers, Lanham, MD.

MacFeely S (2019). The big (data) bang: Opportunities and challenges for compiling SDG indicators. *Global Policy*, Wiley online library, volume 10 - supplement 1. January.

Mack E and Mayer H (2016). The evolutionary dynamics of entrepreneurial ecosystems. *Urban Studies*, 53(10): 2118–2133.

Maestas N, Mullen KJ and Powell D (2016). The effect of population aging on economic growth, the labor force and productivity. NBER Working Paper No. 22452. Cambridge, MA.

Malecki EJ (2018). Entrepreneurship and entrepreneurial ecosystems. *Geography Compass,* 12(3). Wiley Online Library.

Malecki EJ and Moriset B (2007). *The Digital Economy: Business Organization, Production Processes and Regional Developments*. Routledge, London.

Mann L, Graham M and Friederici N (2014). The Internet and business process outsourcing in East Africa: Value chains and networks of connectivity-based enterprises in Kenya and Rwanda. Oxford Internet Institute, University of Oxford, Oxford.

Manyika, J, Pélissié du Rausas M, Hazan E, Bughin J, Chui M and Said R (2011). Internet matters: The Net's sweeping impact on growth, jobs and prosperity. McKinsey Global Institute, Washington, DC.

Manyika J, Bughin J, Lund S, Nottebaum O, Poulter D, Jauch S and Ramaswamy S (2014). Global flows in a digital age: How trade, finance, people, and data connect the world economy. McKinsey Global Institute, Washington, DC.

Manyika J, Lund S, Bughin J, Woetzel J, Stamenov K and Dhingra D (2016). Digital globalization: The new era of global flows. McKinsey Global Institute, Washington, DC.

Marchant E (2018). Anyone anywhere: Narrating African innovation in a global community of practice (PhD dissertation). University of Pennsylvania, Philadelphia, PA. Available at: https://repository.upenn.edu/edissertations/2746.

Markham M (2005). *The Transfer Pricing of Intangibles*. Kluwer Law International B.V., The Hague.

Mayer J (2018). Digitalization and industrialization: Friends or foes? UNCTAD Research Paper 25, UNCTAD, Geneva.

Mayer-Schönberger V and Cukier K (2013). *Big Data: A Revolution That Will Transform How We Live, Work, and Think*. Houghton Mifflin Harcourt, Boston, MA.

Mayer-Schönberger V and Ramge T (2018). *Reinventing Capitalism in the Age of Big Data.* John Murray, London.

Mazzucato M (2018a). *The Value of Everything: Making and Taking in the Global Economy*. Allen Lane, London.

Mazzucato M (2018b). Let's make private data into a public good. *MIT Technology Review*. 27 June.

Mbiti I and Weil DN (2011). Mobile banking: The impact of M-Pesa in Kenya. Working Paper No. 17129. NBER, Cambridge, MA.

McConaghy T (2016). Tokenize the enterprise. (The BigchainDB Blog, 6 June). Available at: https://blog.bigchaindb.com/tokenize-the-enterprise-23d51bafb536 .

McKenzie DJ (2015). Identifying and spurring high-growth entrepreneurship: Experimental evidence from a business plan competition. World Bank Policy Research Working Paper No. No. 7391. World Bank, Washington, DC.

McKinsey (2019). Globalization in transition: The future of trade and value chains. Available at: https://www.mckinsey.com/featured-insights/innovation-and-growth/globalization-in-transition-the-future-of-trade-and-value-chains.

Meagher K (2016). The scramble for Africans: Demography, globalisation and Africa's informal labour markets. *The Journal of Development Studies*, 52(4): 483–497.

Meessen P and Sonnino A (2018). Initial decentralised models for data and identity management: Blockchain and ABC MVPs. DECODE, Barcelona. Available at: https://decodeproject.eu/publications/initial-decentralised-models-data-and-identity-management-blockchain-and-abc-mvps.

Melia E (2019). The impact of information and communication technologies on jobs in Africa: A literature review. Discussion paper 3/2019. German Development Institute, Bonn.

Merkel J (2015). Coworking in the city. *Ephemera: Theory & Politics in Organization*, 15(1), 121–139.

Ministry of Commerce and Industry, India (2018). Review of the policy on foreign direct investment in e-commerce, Press note No. 2. Government of India, Delhi. Available at: https://dipp.gov.in/sites/default/files/pn2_2018.pdf.

Miura Y (2018). China's digital economy: Assessing its scale, development stage, competitiveness, and risk factors. *Pacific Business and Industries*, XVIII (70).

Morawczynski O (2009). Exploring the usage and impact of "transformational" mobile financial services: The case of M-PESA in Kenya. *Journal of Eastern African Studies*, 3(3): 509–525.

Morozov E (2017). To tackle Google's power, regulators have to go after its ownership of data. *The Guardian*, 1 July.

Mozilla (2018). Taxing social media in Africa. In Internet Health Report.org., v.1.0. Available at: https://d20x8vt12bnfa2.cloudfront.net/2019/2019InternetHealthReport_shortversion.pdf.

Mueller M and Grindal K (2018). Is it "trade?" Data flows and the digital economy. Paper presented at the 46th Research Conference on Communication, Information and Internet Policy at American University's Washington College of Law (WCL), Washington, DC, 21-22 September, 2018. Available at: http://dx.doi.org/10.2139/ssrn.3137819.

Nahles A (2018). Die Tech-Riesen des Silicon Valleys gefährden den fairen Wettbewerb. *Handelsblatt*, 13 August. Available at: https://www.handelsblatt.com/meinung/gastbeitraege/gastkommentar-die-tech-riesen-des-silicon-valleys-gefaehrden-den-fairen-wettbewerb/22900656.html.

Nakamura L, Samuels J and Soloveichik R (2017). Measuring the "free" digital economy within the GDP and productivity accounts. ESCoE Discussion Paper 2017–03. Economic Statistics Centre of Excellence, London.

Nambisan S (2017). Digital entrepreneurship: Toward a digital technology perspective of entrepreneurship. *Entrepreneurship Theory and Practice*, 41(6): 1029–1055.

Nambisan S, Lyytinen K, Majchrzak A and Song M (2017). Digital innovation management: Reinventing innovation management research in a digital world. *MIS Quarterly*, 41(1); 223–238.

NASSCOM (2018). Catalyzing the ecosystem for a trillion dollar digital economy. National Association of Software and Services Companies, Hyderabad. Available at: https://www.nasscom.in/sites/default/files/NASSCOM-annual-guidance-fy-2018.pdf.

Ndemo B and Weiss T, eds. (2017). *Digital Kenya: An Entrepreneurial Revolution in the Making*. Palgrave Macmillan, London.

Neufeind M, O'Reilly J and Ranft F, eds. (2018). *Work in the Digital Age: Challenges of the Fourth Industrial Revolution*. Rowman & Littlefield International, London.

Newman N (2014). Search, antitrust and the economics of the control of user data. *Yale Journal on Regulation*, 31(2): 401–454.

Nicholson JR (2016). ICT-enabled services trade in the European Union. United States Department of Commerce Economics and Statistics Administration, Office of the Chief Economist. Available at: https://www.commerce.gov/news/reports/2016/08/ict-enabled-services-trade-european-union.

Nicholson JR (2018). Measuring digital trade in the U.S.: Overview of activities at the U.S. Bureau of Economic Analysis. Presentation at UNCTAD E-Commerce Week, Geneva, 16 April. Available at: http://unctad.org/meetings/en/Presentation/dtl_eWeek2018p05_JessicaNicholson_en.pdf.

O'Mahony S and Ferraro F (2007). The emergence of governance in an open source community. *Academy of Management Journal*, 50(5): 1079–1106.

Obstfeld D (2017). *Getting New Things Done: Networks, Brokerage, and the Assembly of Innovative Action*. Stanford Business Books, an imprint of Stanford University Press, Stanford, CA.

OECD (2012a). *OECD Internet Economy Outlook 2012*. OECD Publishing, Paris.

OECD (2012b). Information and communication technologies and productivity growth. A survey of the literature. OECD Digital Economy Papers No. 195. OECD Publishing, Paris.

OECD (2014). *Measuring the Digital Economy: A New Perspective*. OECD Publishing, Paris.

OECD (2015). *Addressing the Tax Challenges of the Digital Economy, Action 1 - 2015 Final Report*. OECD/G20 Base Erosion and Profit Shifting Project. Paris.

OECD (2016a). Ministerial Declaration on the Digital Economy ("Cancún Declaration") from the Meeting on The Digital Economy: Innovation, Growth and Social Prosperity, Cancun, 21–23 June 2016. Available at: https://www.oecd.org/internet/Digital-Economy-Ministerial-Declaration-2016.pdf.

OECD (2016b). *Big Data: Bringing Competition Policy to the Digital Era.* (DAF/COMP(2016)14). Paris.

OECD (2016c). New forms of work in the digital economy. Working Paper No. 260. Paris.

OECD (2017a). *OECD Digital Economy Outlook 2017*. OECD Publishing, Paris.

OECD (2017b). *Inclusive Framework on BEPS*. Background Brief. Paris.

OECD (2018a). *Tax Challenges Arising from Digitalisation: Interim Report 2018.* Inclusive Framework on BEPS. OECD/G20 Base Erosion and Profit Shifting Project, Paris.

OECD (2018b). *Good Jobs for All in a Changing World of Work: The OECD Jobs Strategy*. OECD Publishing, Paris.

OECD (2018c). *The Future of Social Protection: What Works for Non-standard Workers?* OECD Publishing, Paris.

OECD (2019a). Data in the digital age. Paris. Available at: https://www.oecd.org/going-digital/data-in-the-digital-age.pdf.

OECD (2019b). Productivity growth in the digital age. Paris. Available at: http://www.oecd.org/going-digital/productivity-growth-in-the-digital-age.pdf

OECD (2019c). *Measuring the Digital Transformation. A Roadmap for the Future*. OECD Publishing, Paris.

OECD (2019d). *Going Digital: Shaping Policies, Improving Lives*. OECD Publishing, Paris.

OECD (2019e). Tax and digitalization. Paris. Available at: https://www.oecd.org/going-digital/tax-and-digitalisation.pdf.

OECD (2019f). International community makes important progress on the tax challenges of digitalization. Press release. Paris. Available at: http://www.oecd.org/tax/international-community-makes-important-progress-on-the-tax-challenges-of-digitalisation.htm.

OECD (2019g). Addressing the tax challenges of the digitalisation of the economy. Public Consultation Document, 13 February–6 March 2019. BEPS Project, Paris.

OECD and WTO (2017). *Aid for Trade at a Glance 2017: Promoting Trade, Inclusiveness and Connectivity for Sustainable Development*. WTO and OECD publishing. Geneva and Paris.

Ojanperä S, Graham M and Zook M (2016). Measuring the contours of the global knowledge economy with a digital index. Paper presented at the Development Studies Association Conference 2016, Oxford, 6 September.

Ojanperä S, Graham M, Straumann R, Sabbata SD and Zook M (2017). Engagement in the knowledge economy: Regional patterns of content creation with a focus on sub-Saharan Africa. *Information Technologies & International Development*, 13: 33–51.

Okediji R (2018). Creative markets and copyright in the fourth industrial era: Reconfiguring the public benefit for a digital trade economy. ICTSD Issue Paper No. 43. International Centre for Trade and Sustainable Development, Geneva.

Open Data Institute (2018). Personal data in transport: Exploring a framework for the future. Available at: https://theodi.org/article/personal-data-in-transport-exploring-a-framework-for-the-future-report/.

Oxera (2015). Benefits of online platforms. Oxford. Available at: https://www.oxera.com/wp-content/uploads/2018/07/The-benefits-of-online-platforms-main-findings-October-2015.pdf.pdf.

Oxford Economics (2018). Google data centers: Economic impact and community benefit. Oxford. Available at: http://www.oxfordeconomics.com.au/my-oxford/projects/430231.

Parker GG, Alstyne MWV and Choudary SP (2016). *Platform Revolution: How Networked Markets are Transforming the Economy – And How to Make Them Work for You*. 1st edition. W. W. Norton & Company, New York, NY.

Pasquale F (2013). *Privacy, Antitrust, and Power. George Mason Law Review,* 20(4):1009–1024.

Pasquale F (2018). Data nationalization in the shadow of social credit systems. (Law and Political Economy blog, 18 June). Available at: https://lpeblog.org/2018/06/18/data-nationalization-in-the-shadow-of-social-credit-systems/.

Philippine Statistics Authority (2015). Annual survey of Philippine business and industry (final results). Available at: https://psa.gov.ph/content/2015-annual-survey-philippine-business-and-industry-aspbi-economy-wide-all-establishments.

Pombo C, Gupta R and Stankovic M (2018). Social services for digital citizens: Opportunities for Latin America and the Caribbean. Inter-American Development Bank, Washington, DC.

Ponte S and Gibbon P (2005). Quality standards, conventions and the governance of global value chains. *Economy and Society*, 34(1): 1–31.

Ponte S and Sturgeon T (2014). Explaining governance in global value chains: A modular theory-building effort. *Review of International Political Economy*, 2(1): 1–29.

Prahalad CK and Hamel G (1990). The core competence of the corporation. *Harvard Business Review*, (May–June): 3–22.

PwC (2017). Sizing the prize: What's the real value of AI for your business and how can you capitalise? PricewaterhouseCoopers. London.

PwC (2018a). The 2018 Global Innovation 1000 study: Investigating trends at the world's 1000 largest corporate R&D spenders. London. Available at: https://www.strategyand.pwc.com/innovation1000.

PwC (2018b). Global top 100 companies by market capitalisation (31 March update). Available at: https://www.pwc.com/gx/en/audit-services/assets/pdf/global-top-100-companies-2018-report.pdf .

Quinones G, Heeks R and Nicholson B (2017). Digital start-ups in the global South: Embeddedness, digitality and peripherality in Latin America. Development Informatics Working Paper Series No. 67. Centre for Development Informatics, Global Development Institute, University of Manchester, Manchester.

Quismorio BA (2018). Capability building for data analytics and artificial intelligence. Presentation at the third session of Intergovernmental Group of Experts on E-Commerce and the Digital Economy, UNCTAD, Geneva, 5 April. Available at: https://unctad.org/meetings/en/Presentation/tdb_ede3_2019_p11_BQuismorio_en.pdf.

Rahman KS (2018a). Regulating informational infrastructure: Internet platforms as the new public utilities. *Georgetown Law Technology Review*, 2(2): 234–251.

Rahman KS (2018b). The new utilities: Private power, social infrastructure, and the revival of the public utility concept. *Cardozo Law Review,* 39(5): 1621–1689.

Ravallion M (2019). Guaranteed employment or guaranteed income? *World Development*, 115: 209–221.

Ravishankar MN (2018). Digital social entrepreneurship in India. Development Implications of Digital Economies (DIODE) Research Network, University of Manchester, Manchester.

Rehnberg M and Ponte S (2018). From smiling to smirking? 3D printing, upgrading and the restructuring of global value chains. *Global Networks*, 18(1): 57–80.

Remes J, Manyika J, Bughin J, Woetzel J, Mischke J and Krishnan M (2018). Solving the productivity puzzle: The role of demand and the promise of digitization. McKinsey Global Institute, Washington, DC.

RIS (2018). Unleash, not squeeze, Uganda's ICT sector. Research ICT Solutions, North Vancouver, BC.

Ritzer G and Jurgenson N (2010). Production, consumption, prosumption: The nature of capitalism in the age of the digital 'prosumer'. *Journal of Consumer Culture*, 10(1): 13–36.

Rochet J-C and Tirole J (2003). Platform competition in two-sided markets. *Journal of the European Economic Association*, 1(4): 990–1029.

Rochet J-C.and Tirole J (2006). Two-sided markets: A progress report. *The RAND Journal of Economics*, 37(3): 645–667.

Royal Society and British Academy (2018). AI and work: A Royal Society and British Academy evidence synthesis on implications for individuals, communities, and societies. London. Available at: https://royalsociety.org/topics-policy/projects/ai-and-work/.

RTI International (2018). The impact of Facebook's U.S. Data Center Fleet. Research Triangle Park, NC. Available at: https://www.rti.org/sites/default/files/facebook_data_centers_2018.pdf.

Ruef M (2010). *The Entrepreneurial Group: Social Identities, Relations, and Collective Action.* Princeton University Press, Princeton.

SAICA (2019). The tax predicament within the digitalised economy. South American Institute of Chartered Accountants. *Integritax,* February: 56–61. Available at: https://www.accountancysa.org.za/wp-content/uploads/2019/02/SAICA-Feb-Intergritax.pdf.

Samuelson P and Scotchmer S (2001). The law and economics of reverse engineering. 111 *Yale Law Journal*: 1575–1663.

Sarpong E (2018). How some African governments are keeping millions of citizens offline. (Blog). World Wide Web Foundation. Available at: https://webfoundation.org/2018/11/how-some-african-governments-are-keeping-millions-of-citizens-offline/.

Schatan C and Enríquez L (2015). Mexico: Industrial policies and the production of information and communication technology goods and services. *CEPAL Review*, December.

Schlogl L and Sumner A (2018). The rise of the robot reserve army: Automation and the future of economic development, work, and wages in developing countries. Working Paper 487. Center for Global Development, Washington, DC.

Schmidt S and Brinks V (2017). Open creative labs: Spatial settings at the intersection of communities and organizations. *Creativity and Innovation Management*, 26(3): 291–299.

Schumpeter JA (1942). *Capitalism, Socialism and Democracy.* Third edition. Harper Perennial Modern Thought (2008). New York, NY.

Select Committee on Artificial Intelligence (2018). AI in the UK: Ready, willing and able? House of Lords, London.

Sen N (2018). Understanding the role of the WTO in international data flows: Taking the liberalization or the regulatory autonomy path? *Journal of International Economic Law*, 21: 323–348.

Seo-Zindy R and Heeks R (2017). Researching the emergence of 3D printing, makerspaces, hackerspaces and fablabs in the global South: A scoping review and research agenda on digital innovation and fabrication networks. *The Electronic Journal of Information Systems in Developing Countries*, 80(1): 1–24.

Simpson P (2016). The secrets behind Amazon's success. Available at: https://www.cips.org/en/supply-management/analysis/2016/february/the-secrets-behind-amazons-success/.

Singh PJ (2018). Digital industrialisation in developing countries: A review of the business and policy landscape. IT for Change, Delhi.

Solow R (1987). We'd better watch out. New York Times Book Review, *New York Times*, New York, 12 July: 36.

Spigel B (2017). The relational organization of entrepreneurial ecosystems. *Entrepreneurship Theory and Practice*, 41(1): 49–72.

Spigel B and Harrison R (2018). Toward a process theory of entrepreneurial ecosystems. *Strategic Entrepreneurship Journal*, 12(1): 151–168.

Srnicek N (2017). *Platform Capitalism*. Polity Press, Cambridge Malden, MA.

Stam E (2015). Entrepreneurial ecosystems and regional policy: A sympathetic critique. *European Planning Studies*, 23(9): 1759–1769.

Stam E and Spigel B (2018). Entrepreneurial ecosystems. In: Blackburn RA, De Clercq D, Heinonen J and Wang Z, eds. *Handbook for Entrepreneurship and Small Business*. SAGE Publications, London: 1–21.

Stanley TD, Doucouliagos H and Steel P (2018). Does ICT generate economic growth? A meta-regression analysis. *Journal of Economic Surveys*, 32(3): 705–726.

Startup Genome (2017). *The 2017 Global Startup Ecosystem Report*. San Francisco, CA.

Stewart J (2016). MNE tax strategies and Ireland. School of Business, Trinity College, Dublin.

Stiglitz J (2017). Towards a broader view of competition policy. In: Bonakele T, Fox E and Mncube L, eds. *Competition Policy for the New Era: Insights from the BRICS Countries*. Oxford University Press, Oxford: 4–21.

Stork C, Esselaar S and Chair C (2017). OTT: Threat or opportunity for African Telcos? *Telecommunications Policy*, 41(7–8): 600–616.

Storper M, Kemeny T, Makarem NP and Osman T (2015). *The Rise and Fall of Urban Economies: Lessons from San Francisco and Los Angeles*. Stanford Business Books, Stanford University Press, Stanford, CA.

Straube T (2016). Stacked spaces: Mapping digital infrastructures. *Big Data & Society*, 3(2): 1–12.

Stucke M and Grunes A (2016). *Big Data and Competition Policy*. Oxford University Press, Oxford.

Sturgeon T (2002). Modular production networks: A new American model of industrial organization. *Industrial and Corporate Change*, 11(3): 451–496.

Sturgeon T (2017). The 'new' digital economy and development. Technical note. (TN/UNCTAD/ICT4D/08). UNCTAD, Geneva.

Sturgeon T (2018). Measuring the 'new' digital economy. In: Eurostat, *Power from Statistics: Data Information and Knowledge – Outlook Report 2018.* Publications Office of the European Union, Luxembourg: 131–148.

Sturgeon TJ and Zylberberg E (2016). The global information and communications technology industry: Where Vietnam fits in global value chains. Policy Research Working Paper no WPS 7916, World Bank Group, Washington, DC.

Sussan F and Acs ZJ (2017). The digital entrepreneurial ecosystem. *Small Business Economics,* 49(1): 55–73.

Swedish National Board of Trade (2014). No transfer, no trade: The importance of cross-border data transfers for companies based in Sweden. Stockholm.

Synergy Research Group (2019). Fourth quarter growth in cloud services tops off a banner year for cloud providers. Reno, NV. Available at: https://www.srgresearch.com/articles/fourth-quarter-growth-cloud-services-tops-banner-year-cloud-providers.

Taplin J (2017a). *Move Fast and Break Things: How Facebook, Google, and Amazon have Cornered Culture and What It Means for All of Us*. Macmillan, London.

Taplin J (2017b). Is it time to break up Google? *The New York Times*, 22 April. Available at: https://www.nytimes.com/2017/04/22/opinion/sunday/is-it-time-to-break-up-google.html.

Tapscott D (1996). *The Digital Economy: Promise and Peril in the Age of Networked Intelligence.* McGraw-Hill, New York, NY.

Tarnoff B (2018). The data is ours! What is big data? And how do we democratize it? *Logic Magazine*, May.

Täuscher K (2016). Business Models in the digital economy: An empirical classification of digital marketplaces. Fraunhofer Center for International Management and the Knowledge Economy, Leipzig.

The BEPS Monitoring Group (2017). Tax challenges of the digital economy. Submission in response to the Request for Comments by the OECD in connection with the work of the Task Force on the Digital Economy in preparing a report for the G20. Available at: https://bepsmonitoringgroup.wordpress.com/2017/10/18/tax-challenges-of-the-digital-economy/.

Thun E and Sturgeon T (2017). When global technology meets local standards: Reassessing the China's mobile telecom policy in the age of platform innovation. In: Brandt L and Rawski T, eds. *The Impact of Industrial Policy and Regulation on Upgrading and Innovation in Chinese Industry*. Cambridge University Press, Cambridge.

Tiamiyu MA, Bankole AS and Agbonlahor RO (2012). Catalytic mechanisms for promoting ICT investment and use in cassava value chains in south-western Nigeria. *Information Development*, 28(2): 132–148.

Tilson D, Lyytinen K and Sørensen C (2010). Digital infrastructures: The missing IS research agenda – Research commentary. *Information Systems Research*, 21(4): 748–759.

Tiwana A (2014). *Platform Ecosystems: Aligning Architecture, Governance, and Strategy*. Morgan Kaufmann Publishers Inc. San Francisco, CA.

Toivonen T and Friederici N (2015). Time to define what a "hub" really is. *Stanford Social Innovation Review*. (Blog). Available at: http://www.ssireview.org/blog/entry/time_to_define_what_a_hub_really_is.

Tong-hyung K (2011). Cyworld fights back Facebook-Twitter onslaught with C-Log. *The Korea Times*, 22 November. Available at: http://www.koreatimes.co.kr/www/tech/2018/11/133_76767.html.

Torres Mora R (2018). Costa Rica: Exports of services over information and communication technology networks (ICT). Presentation at "Measuring Exports of Digitally-delivered Services" event, UNCTAD eCommerce Week 2018. Geneva, 16 April. Available at: http://unctad.org/meetings/en/Presentation/dtl_eWeek2018p03_RigobertoTorresMora_en.pdf.

UNCTAD (2010). *Trade and Development Report 2010: Employment Globalization and Development* (United Nations publication, Sales No. E.10.II.D.3. New York and Geneva).

UNCTAD (2011). *Information Economy Report 2011: ICTs as an Enabler for Private Sector Development* (United Nations publication, Sales No. E.11.II.D.6. New York and Geneva).

UNCTAD (2012a). *Information Economy Report 2012: The Software Industry and Developing Countries*. (United Nations publication, Sales No. E.12.II.D.14. New York and Geneva).

UNCTAD (2012b). *Trade and Development Report 2012: Policies for Inclusive and Balanced Growth* (United Nations publication, Sales No. E.12.II.D.6. New York and Geneva).

UNCTAD (2013). *Information Economy Report 2013*: *The Cloud Economy and Developing Countries* (United Nations publication, Sales No. E.13.II.D.6. New York and Geneva).

UNCTAD (2015a). *Global Assessment of Sex-Disaggregated ICT Employment Statistics. Data Availability and Challenges on Measurement and Compilation*. UNCTAD Technical Notes on ICT for Development No.4. Geneva.

UNCTAD (2015b). International trade in ICT services and ICT-enabled services: Proposed indicators from the Partnership on Measuring ICT for Development. UNCTAD Technical Notes on ICT for Development No. 3. Geneva.

UNCTAD (2015c). *World Investment Report 2015: Reforming International Investment Governance*. UNCTAD/WIR/2015. Geneva and New York.

UNCTAD (2015d). *Information Economy Report 2015: Unlocking the Potential of E-commerce for Developing Countries* (United Nations publication, Sales No. E.15.II.D.1. New York and Geneva).

UNCTAD (2016). *Data Protection Regulations and International Data Flows: Implications for Trade and Development*. UNCTAD/WEB/DTL/STICT/2016/1/iPub. United Nations publication, Geneva.

UNCTAD (2017a). *Information Economy Report 2017: Digitalization, Trade and Development*. (United Nations publication, Sales No. Sales No. E.17.II.D.8, New York and Geneva).

UNCTAD (2017b). *World Investment Report 2017: Investment and the Digital Economy*. UNCTAD/WIR/2017. Geneva.

UNCTAD (2017c). *Trade and Development Report 2017: Beyond Austerity – Towards a Global New Deal* (United Nations publication, Sales No. Sales No. E.17.II.D.5. New York and Geneva).

UNCTAD (2017d). *Economic Development in Africa Report 2017: Tourism for Transformative and Inclusive Growth* (United Nations publication, Sales No. E.17.II.D.2. New York and Geneva).

UNCTAD (2017e). ICT Policy Review: National E-commerce Strategy for Egypt. UNCTAD/DTL/STICT/2017/3. Geneva.

UNCTAD (2018a). *Technology and Innovation Report 2018: Harnessing Frontier Technologies for Development* (United Nations publication, Sales No.E.18.II.D.3. New York and Geneva).

UNCTAD (2018b). Fostering development gains from e-commerce and digital platforms. Background note for the Intergovernmental Group of Experts on E-Commerce and the Digital Economy. TD/B/EDE/2/2. Geneva.

UNCTAD (2018c). Updating the Partnership Definition of ICT Goods from HS 2012 to HS 2017. ICT4D Technical Note 10. Geneva.

UNCTAD (2018d). Implementing a survey on exports of ICT-enabled services. Technical Notes on ICT for Development No. 11. Geneva.

UNCTAD (2018e). *The Least Developed Countries Report 2018: Entrepreneurship for Structural Transformation – Beyond Business as Usual* (United Nations publication, Sales No. Sales No: E.18.II.D.6, Geneva).

UNCTAD (2018f). *Rapid ETrade Readiness Assessments of African Least Developed Countries*. Geneva. Available at: https://unctad.org/en/PublicationsLibrary/dtlstict2018_eTrade_overview_en.pdf.

UNCTAD (2018g). *Trade and Development Report 2018: Power, Platforms and the Free Trade Delusion* (United Nations publication, Sales No. E.18.II.D.7 New York and Geneva).

UNCTAD (2019a). Competition issues in the digital economy. TD/B/C.I/CLP/54. Geneva.

UNCTAD (2019b). *UNCTAD Rapid eTrade Readiness Assessments of Least Developed Countries: Policy Impact and Way Forward*. Geneva. Available at: https://unctad.org/en/PublicationsLibrary/dtlstict2019d7_en.pdf.

UNCTAD (2019c*). A Framework for Science, Technology and Innovation Policy Reviews: Harnessing Innovation for Sustainable Development.* UNCTAD/DTL/STICT/2019/4. Geneva.

UNCTAD (2019d). Donor Support to the Digital Economy in Developing Countries: A 2018 Survey of Public and Private Organizations. UNCTAD Technical Notes on ICT for Development No. 13. Geneva.

UN-DESA (2018). *World Economic and Social Survey 2018*: *Frontier Technologies for Sustainable Development.* Department of Economic and Social Affairs United Nations publications, E/2018/50/Rev.1 ST/ESA/370, New York.

UNECA (2017). *Blockchain Technology in Africa*. United Nations Economic Commission for Africa, Addis Ababa. Available at: https://www.uneca.org/sites/default/files/images/blockchain_technology_in_africa_draft_report_19-nov-2017-final_edited.pdf.

UNEP (2014). *Fintech, Green Finance and Developing Countries*. United Nations Environment Programme, Nairobi.

UNESCO (2019). *UNESCO's Internet Universality Indicators: A Framework for Assessing Internet Development.* Paris.

United Nations (2008). International Standard Industrial Classification of All Economic Activities. Revision 4. New York, NY.

United Nations (2018). *Subcommittee on Tax Challenges related to the Digitalization of the Economy.* E/C.18/2018/CRP.12. New York.

United Nations (2019a). Tax issues related to the digitalization of the economy. Paper prepared by the Subcommittee on Tax Challenges Related to the Digitalization of the Economy for discussion by the Committee of Experts on International Cooperation in Tax Matters at its 18th Session, New York, 23-26 April 2019. E/C.18/2019/CRP.12. New York, NY.

United Nations (2019b). Draft intergovernmentally agreed conclusions and recommendations submitted by the President of the Economic and Social Council, Inga Rhonda King (Saint Vincent and the Grenadines), on the basis of informal consultations. Follow-up and review of the financing for development outcomes and the means of implementation of the 2030 Agenda for Sustainable Development. Available at: https://undocs.org/pdf?symbol=en/E/FFDF/2019/L.1

UNSC (2016). *Report of the Partnership on Measuring Information and Communications Technology for Development: Information and Communications Technology Statistics*. United Nations Statistical Commission. E/CN.3/2016/13. New York, NY.

UNSGSA (2018). Briefing on Regulatory Sandboxes by the UNSGSA's Fintech Sub-Group on Regulatory Sandboxes. United Nations Secretary-General's Special Advocate for Inclusive Finance for Development. Available at: https://www.unsgsa.org/files/1915/3141/8033/Sandbox.pdf.

United States Chamber of Commerce (2016). Preventing deglobalization: An economic and security argument for free trade and investment in ICT. Washington, DC.

United States Department of Commerce (2016). Measuring the value of cross-border data flows. Washington, DC. Available at: https://www.ntia.doc.gov/files/ntia/publications/measuring_cross_border_data_flows.pdf.

Van Alstyne MW, Parker GG and Choudary SP (2016). Pipelines, platforms, and the new rules of strategy. *Harvard Business Review*, 94(4): 54–62.

Varda K (2018). The rise of edge compute. (Blog) Available at: https://blog.cloudflare.com/rise-of-edge-compute-the-video/.

VC4Africa (2014). 2015 venture finance in Africa: The progress of early-stage high-potential growth companies. Available at : http://www.aspeninstitute.org/sites/default/files/content/docs/resources/Summary%20VC4Africa%202015%20Report%20-%20Venture%20Finance%20in%20Africa.pdf.

VC4Africa (2016). 2016 venture finance in Africa: New data shows growing investor appetite in African early stage startups. Available at: https://vc4a.com/blog/2016/05/18/new-data-shows-growing-investor-appetite-in-african-early-stage-startups/.

VC4Africa (2017). 2017 venture finance in Africa: VC4A research proves founder teams are key to startup success in Africa. Available at: https://vc4africa.africa-newsroom.com/press/vc4a-research-proves-founder-teams-are-key-to-startup-success-in-africa.

VC4Africa (2018). 2018 venture finance in Africa. Available at: https://vc4a.com/research/.

von Hippel E (1988). *The Sources of Innovation*. Oxford University Press, Oxford.

Vox-Recode (2019). Google, Amazon, and Facebook all spent record amounts last year lobbying the US government. 23 January. Available at: https://www.vox.com/2019/1/23/18194328/google-amazon-facebook-lobby-record.

Weber S (2017). Data, development, and growth. *Business and Politics,* 19(3): 397–423.

Wessman R (2015). Managing the Nokia shock. *Magma Pamphlet* 2. Available at: http://magma.fi/uploads/media/study/0001/01/c65b60e92de8819211e03eb115988cb3ad225484.pdf.

WIPO (2019). *WIPO Technology Trends 2019: Artificial Intelligence*. World Intellectual Property Organization. Geneva.

World Bank (2016). *World Development Report 2016: Digital Dividends*. Washington, DC.

World Bank (2018a). *World Development Report 2019: The Changing Nature of Work*. Washington DC.

World Bank (2018b). *Information and Communications for Development 2018: Data-Driven Development.* Washington, DC.

World Bank (2018c). Cryptocurrencies and Blockchain: Europe and Central Asia Economic Update. Washington DC.

World Economic Forum (2018). *The Future of Jobs Report 2018*. Geneva. Available at: http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf.

World Wide Web Foundation and Alliance for an Affordable Internet (2018). Closing the investment gap: How multilateral development banks can contribute to digital inclusion. Available at: http://a4ai.org/wp-content/uploads/2018/04/MDB-Investments-in-the-ICT-Sector.pdf.

WTO (2018). *World Trade Report 2018: The Future of World Trade – How Digital Technologies are Transforming Global Commerce*. World Trade Organization, Geneva.

Wu T (2016). *The Attention Merchants: The Epic Scramble to Get Inside Our Heads*. Penguin Random House, New York, NY.

Yao X, Zhou J, Zhang J and Boër CR (2017). From intelligent manufacturing to smart manufacturing for industry 4.0 driven by next generation artificial intelligence and further on. Paper presented at the 5th International Conference on Enterprise Systems (ES) in Beijing, 22–24 Sept. 2017. Available at: https://doi.org/10.1109/ES.2017.58.

Yoo Y, Henfridsson O and Lyytinen K (2010). Research commentary: The new organizing logic of digital innovation – An agenda for information systems research. *Information Systems Research*, 21(4): 724–735.

Zittrain J (2009). *The Future of the Internet: And How to Stop it.* Penguin, London.

Zuboff S (2015). Big other: Surveillance capitalism and the prospects of an information civilization. *Journal of Information Technology*, 30(1): 75–89. Harvard Business School, Cambridge, MA.

ISBN 978-92-1-112955-7

Layout and Printing at United Nations, Geneva
1911016 **(E)** – July 2019 – 3,151

UNCTAD/DER/2019

United Nations publication