The Digital Roadmap

How developing countries can get ahead

Pathways for Prosperity Commission
Technology & Inclusive Development

BLAVATNIK SCHOOL OF GOVERNMENT

UNIVERSITY OF OXFORD

The final report of the
Pathways for Prosperity Commission

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Foreword

The Pathways for Prosperity Commission was established in January 2018, at a time when the dominant narrative around technology and development was defeatist.

Over the course of these last two years, the Commission has presented three major reports and many background papers that all support a common conclusion: the benefits and drawbacks of technology in development are not preordained; they will reflect the collective actions we take now and in the years ahead.

Our first report, *Charting Pathways for Inclusive Growth*, spelled out the potential of technology across the economy. *Digital Lives* considered questions of digital connectivity and usage. *Positive Disruption* addressed whether digital technology can transform health and education systems.

The Digital Roadmap: how developing countries can get ahead is the culmination of our analysis. It is underpinned by learning derived from extensive engagement with civil society, policymakers, entrepreneurs, academics, and advocates around the world. While in our previous reports we raised questions and debated issues, in this – the Pathways Commission's final report – we lay out implementable, pragmatic recommendations for developing countries that want to seize the opportunity of this moment.

This is not the end of the journey. Of course, what happens next will depend on countries picking up the baton, and implementing these proposals – and on the rest of the world facilitating their efforts. Ensuring that marginalised groups, especially women, have equal access to transformative digital tools will take more work still. And this report is not the final word as to how developing countries should govern the use of technology.

We are proud that the task of the Commission has been fulfilled with *The Digital Roadmap*, and we wish the best of luck to developing nations around the world as they create their digital futures to improve lives and livelihoods for everyone.

Melinda Gates   **Sri Mulyani Indrawati**   **Strive Masiyiwa**

Acknowledgements

About the Pathways Commission

The Pathways for Prosperity Commission on Technology and Inclusive Development is proud to work with a diverse group of commissioners who are global leaders from government, the private sector, and academia.

The Commission is based at The University of Oxford's Blavatnik School of Government. We collaborate with international development partners, developing country governments, private-sector leaders, entrepreneurs, and civil society to produce cutting-edge research.

The Commission aims to catalyse new conversations and to encourage the co-design of country-level solutions aimed at making frontier technologies work for the benefit of the world's poorest and most marginalised men and women.

Pathways Commissioners:

- Melinda Gates – Co-chair of the Bill & Melinda Gates Foundation
- Sri Mulyani Indrawati – Minister of Finance, Indonesia
- Strive Masiyiwa – Founder and Executive Chairman of Econet Group
- Professor Stefan Dercon – Professor of Economic Policy at the Blavatnik School of Government and the Economics Department, and Director of the Centre for the Study of African Economies, University of Oxford
- Professor Benno Ndulu – Mwalimu Nyerere Professorial Chair, University of Dar es Salaam, and Visiting Professor at the Blavatnik School of Government, University of Oxford
- Dr Kamal Bhattacharya – Chief Executive Officer of Mojochat
- Dr Shanta Devarajan – Professor of the Practice of Development at Georgetown University's Edmund A. Walsh School of Foreign Service
- Sigrid Kaag – Minister for Foreign Trade and Development Cooperation, the Netherlands
- Nadiem Makarim – Minister of Education and Culture, Indonesia, and Founder and former Global Chief Executive Officer of GOJEK
- Maria Ramos – Former Chief Executive Officer of Absa Group Limited
- Professor Daniela Rus – Andrew (1956) and Erna Viterbi Professor of Electrical Engineering and Computer Science, and Director of the Computer Science and Artificial Intelligence Laboratory (CSAIL) at the Massachusetts Institute of Technology
- Shivani Siroya – Founder and Chief Executive Officer of Tala
- Dr Vera Songwe (Official Observer to the Commission) – United Nations Executive Secretary of the Economic Commission for Africa (ECA)

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Executive summary

Digital technologies are transforming the world, and nowhere are the stakes higher than in developing countries. With new digital technologies come opportunities for low- and middle-income countries to build new industries, deliver better services, improve markets, and, most importantly, enhance peoples' lives. But the news is not all good. Digital technologies can also entrench exclusion, create new ways for the powerful to abuse the weak, and disrupt – or render obsolete – peoples' livelihoods and jobs. The Pathways for Prosperity Commission has been on a two-year mission to investigate how countries can best navigate this technological disruption so that everyone benefits.

Developing countries are starting from a challenging position, often grappling with some combination of low human capital, ineffective institutions, and a difficult business environment. Developing countries are also rarely digitally ready: less than a quarter of people in low-income countries have ever used the internet. But this does not mean they should be paralysed by change, or that they must resign themselves to be passive observers of this digital revolution. Quite the opposite. Now is the time for countries to take control of their technological futures – as, indeed, many are already starting to do.

The technological revolution at hand is not simply about technology or 'digital policy' in isolation: this transition involves optimising social, political and economic conditions for inclusive growth in the digital age. Technology alone, no matter how innovative, will not guarantee success. Development will come from deploying technologies in a conducive environment, alongside profitable business models, and with the necessary protections in place. Not every country has an existing environment in which firms, individuals and service providers can take full advantage of new digital technologies. Creating this ecosystem is often a case of getting 'analogue' matters right in a digital age.

The use of digital technologies will not automatically lead to the inclusion of the poor and marginalised. Throughout our consultations and research, it has been clear that a large proportion of society is being left behind by technological change. Just as trickle-down growth has failed to deliver inclusive development, so too will trickle-down digitalisation. Civil society groups are right to be concerned about the dangers of digitalisation. When policymakers and private sector decision-makers do not consciously design for inclusiveness, they create a digital world that entrenches disadvantage, rendering inclusion an afterthought, and offering opportunities only to the well-off.

Governments and societies, particularly in developing countries, should not simply step back and let the wave of digital transformation wash over them. They should pick up the tools available to them and become authors of their own technological revolution. This report sets out many of the practical steps that governments, civil society, private firms, investors, donors and citizens can take. After two years of thinking, engagement, research and discussion around the world, the Commission can now, with some confidence, propose specific and practical recommendations for developing countries to take charge of their digital futures. This report presents an overarching vision for a globally connected world that both delivers on the opportunities presented by technology, and protects from associated risks. Importantly, it also sets out how this vision can be achieved.

Figure ES1. **Overview of priorities in *The Digital Roadmap***

Craft a digital compact for inclusive development

Put people at the centre of the digital future

Build the digital essentials

Reach everyone with digital technologies

Govern technology for the future
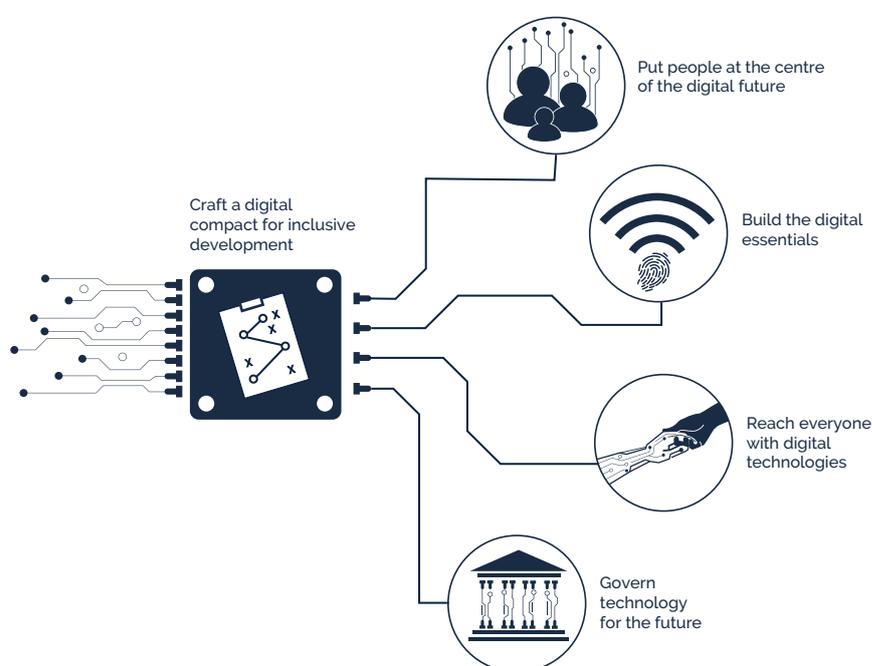
Embracing digital transformation will be disruptive. The creation of a national digital compact can help coordinate action that is needed to navigate such profound changes across society and the economy. Economic transition creates both winners and losers, and growth is rarely inclusive by itself. Inclusive development requires action across all facets of the economy and society – investment in new industries, regulatory changes, skills development, infrastructure prioritisation and more. The best way to coordinate across all these demands is with a national digital compact: a shared political vision of the future between government (in all its functions), the private sector and civil society. All parties have interests at stake, and all have important roles to play in creating the digital future. Working together to balance these trade-offs will allow for the mitigation of the downside of necessary reforms, and make it clear that all sectors need to contribute to positive outcomes.

The future gains from technology-enabled growth will be limited if people are not put at the centre of the digital future. A national digital compact must go beyond simply exploiting economic opportunities or connecting people to the internet for the sake of it. It is just as important to make sure people are equipped to benefit from the opportunities offered by the digital age, while also protecting people from potential harms. To thrive in the digital economy, people need relevant skills, as well as the chance for their voices to be heard. Citizens must be able to trust that digital systems are safe, transparent and accountable. Inevitably, however, some people will be left behind. Digital technologies can make the delivery of social protections more efficient and more effective, to minimise any potential harm to individuals or families in the transition to a new economy and society.

Digital technologies can only operate when essential infrastructure, digital systems, and capital are in place. Many countries hope to use digital products and services to help them achieve inclusive development, but these products and services cannot materialise in a vacuum. A thriving digital economy requires essential physical infrastructure (electricity and internet access), foundational digital systems (digital ID and finance) and investment capital. These are the basic ingredients needed to foster widespread adoption and innovation. Foundational digital systems, in particular, make huge differences for local innovation. For instance, without a system for processing digital payments, entrepreneurs cannot develop platforms and digital markets to enable trade and exchange.

Making technology a force for inclusive development requires deliberate steps to ensure that benefits reach everyone. The digital divide is not defined by infrastructure: 80% of people in developing countries live under a cellular internet signal; yet only 30% have ever used the internet. No amount of construction will make internet access affordable to someone in extreme poverty. Instead, increasing take-up will require new business models to serve the poorest. Governments can use their regulatory levers (such as the allocation of broadcast spectrum licenses) to encourage network operators to pursue greater inclusion, and the operators themselves can explore differentiated pricing models. Beyond network access, other digital products – from phones to farm extension services – need to be designed specifically to reach the marginalised, who often cannot afford or access products built for the middle class. And in considering how to reach the marginalised, countries must also tackle social norms, for example, around gender roles, which severely limit women's usage of digital technology in many parts of the world.

It is incumbent on societies to govern for the future, steering this technological change towards inclusive development. Limited capacity and insufficient resources constrain many governments. Digital technologies cannot fully solve these issues, but they do provide real opportunities to improve governmental administration, and to enhance the quality and reach of public services. Governments must also set regulatory approaches that will shape

the digital future – affecting the business models and tools offered by digital technology. Technological change is creating headaches for regulators in even the most well-resourced countries. Government leaders, particularly in developing countries, will need new and more adaptive approaches to decision-making that focus on learning and continual adjustment. Some rules and regulations will depend on global norms. However, the rich nations and large global bureaucracies that dominate these processes appear unlikely to reflect the needs and priorities of developing countries. Therefore, developing countries may find that their best opportunities for success lie in coordination and cooperation among themselves.

The future is uncertain, but the Pathways Commission is optimistic about the potential of new technologies. If countries prepare for change and manage it well, digital technology can be a powerful force for inclusive development. Technology can power new economic pathways and livelihoods. Technology can improve the quality of critical health and education services. Technology can connect people in new and exciting ways. In all of these cases, success or failure is almost never determined by technology alone, but rather by how it is managed and where it is used. **It is within humanity's power to create a better world for everyone. Technology is one part of that quest. We hope this report helps everyone to push in the right direction.**

Recommendations

Craft a digital compact for inclusive development

1. **Governments, civil society and the private sector** should work together to forge a national compact for inclusive development in the digital age: a shared understanding between key stakeholders to coordinate on complex trade-offs. **Donors, philanthropists and multilateral organisations** should support country initiatives that are backed by such a political compact, rather than pursuing piecemeal and uncoordinated priorities.

2. All parts of **government** – particularly central economic and planning ministries – need to be involved in policymaking addressing technological disruption. Countries should avoid relegating broad digital transformation to technical agencies with only a narrow mandate.

Put people at the centre of the digital future

3. **Governments** should take responsibility for ensuring that vocational education is truly useful for workers and for business in the digital age. They should work with the **private sector** to keep curricula up to date, using their policy levers of accreditation and subsidies to support new forms of lifelong training.

4. The **private sector** should provide on-the-job training and apprenticeship programmes at scale, doing their part for the national digital compact by contributing to skills upgrading across the economy.

5. To cope with rapid change, **governments** should ensure that their citizens – especially children in school – are developing flexible skills, including transferable socio-emotional soft skills, which are complementary to new technologies. **Private-sector** support for general work-readiness programmes can augment such efforts.

6. **Governments** should provide open information about their programmes. At a minimum, provincial and national governments should publish (in digital, machine-readable formats) administrative data and information about budget allocations. **Civil society organisations and donors** can complement this by funding initiatives and communicators to translate such data for citizens.

7. **Civil society, governments, donors and philanthropists** should actively invest in digital platforms designed to involve citizens in decision-making, and ensure their voice is heard in public decisions.

8. All **governments** need to establish a data governance regime. These should reflect their society's norms and expectations. Though there is no single blueprint, a common standard should be that citizens can trust that their personal information is collected and used in ways that are secure, transparent, and accountable, and that the governance regime demonstrates respect for fundamental human rights.

9. **Governments**, with at least initial support from **donors**, where relevant, should strengthen their social protection programmes to support the poorest and those left behind by new economic opportunities – taking advantage of new technologies to cheaply and efficiently deliver support.

Build the digital essentials

10. **The private sector and governments** should create foundational digital systems that are interoperable and easy for others to build upon. **Donors, multilateral organisations and philanthropists** should provide tools, frameworks and funding to assist with this process.

11. **Governments** should implement basic digital identification architecture to allow citizens and businesses to safely and easily authenticate themselves. This will enable citizens to more efficiently access services in formal systems, and will help businesses to better legally establish themselves and attract investment.

12. **Governments** should mandate the development of an interoperable ecosystem of digital payment services, including allowing non-bank actors to operate payment systems with appropriate regulations.

13. **Philanthropists and donors** should focus on supporting projects, including from **private-sector entrepreneurs**, that develop tools and services to reduce the friction and costs associated with investing in digital technology and start-ups in emerging markets (eg tools to perform due diligence on investment prospects).

14. **Governments** should take practical steps to improve the supply of bankable projects in local digital industries. Removing general barriers to doing business – for example, with better accounting standards or business registration – will help at the margins.

15. **Private investors and philanthropists,** in some cases supported by **development banks,** should lead aggregator funds (largely for private capital) and provide guarantees or insurance to de-risk venture investment. In this way, they can help close the funding gap for digital entrepreneurs and innovators in developing countries.

Reach everyone with digital technologies

16. **Mobile network operators** should embrace novel business models that enable the poorest to access services – such as cross-subsidised access, 'freemium' pricing, or public access solutions. **Governments** may need to develop incentives or regulations to encourage these pro-poor innovations.

17. **Governments** should use spectrum broadcast licenses as a tool for inclusion. The allocation of rights is a key touchpoint where governments can shape the market, and the ongoing regulation of broadcast licenses could be loosened to allow small and innovative initiatives to spring up – for instance, through 'fair use' rules or secondary markets.

18. **The private sector** should seek opportunities to create useful digital products for the poorest. Striking the right balance between profitability, affordability and user experience may require designing specifically with inclusion in mind, developing 'lite' products, automating processes, or building products at different scales.

19. **Philanthropists, donors and governments** should support the design of digital products for the most marginalised people, by continuing to fund early-stage innovations, or by incentivising companies that demonstrate social impact.

20. **The private sector and civil society** should create specific opportunities for women to engage with technology (through, for example, women-only internet cafes or skills labs), incorporating an understanding of the social norms that might affect usage.

21. **Philanthropists, civil society, the private sector and governments** must actively challenge existing gender norms that restrict women's use of digital technology. Ways forward include promoting 'connected' female role models, and showing leaders and peers rejecting old norms.

Govern technology for the future

22. **Governments** should actively look for opportunities to use digital tools to improve the effectiveness, efficiency and reach of public administration and service delivery. This might include providing educational resources tailored to students' needs, distributing tax refunds via mobile money, or using national-level insights to manage pharmaceutical supplies.

23. **Governments** need new adaptive and flexible approaches (such as risk-weighted rules or regulatory sandboxes) to tackle the regulatory challenges emerging from digitalisation. They should not assume that old regulation is still fit for purpose in the digital age.

24. **Governments** should leverage data to inform regulatory decision-making, working with the **private sector** to build systems that improve officials' understanding of the industries they regulate.

25. **Governments, philanthropists and multilateral organisations** should support bold, new efforts to develop first-best regulatory solutions designed to meet the unique needs and priorities of developing countries.

26. Developing country **governments** should coordinate on technology governance at the regional and international levels where their values and interests align, and **multilateral organisations** must be responsive to the needs of developing countries when creating global standards.
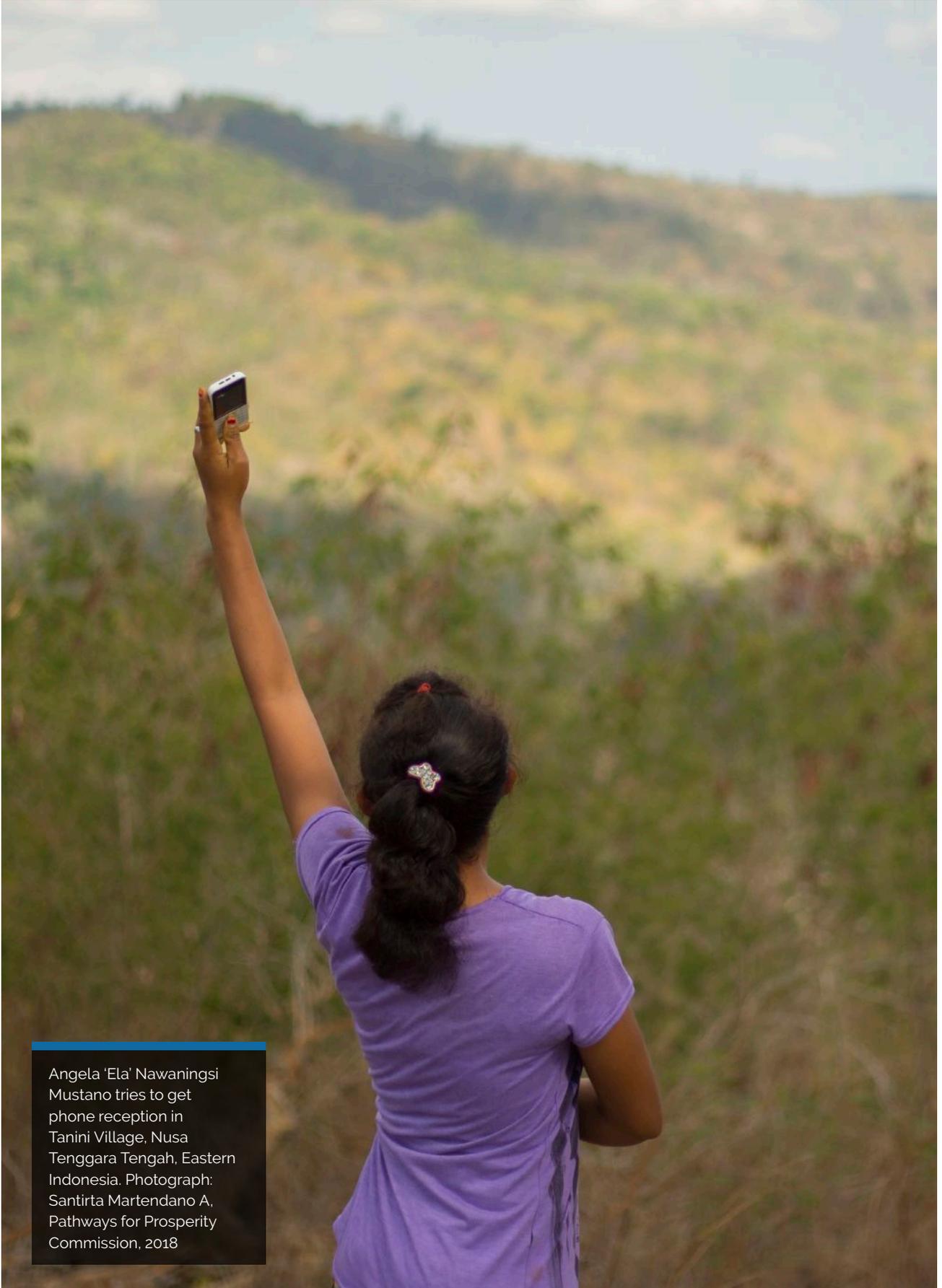
Angela 'Ela' Nawaningsi Mustano tries to get phone reception in Tanini Village, Nusa Tenggara Tengah, Eastern Indonesia. Photograph: Santirta Martendano A, Pathways for Prosperity Commission, 2018

Chapter 1
Introduction

The Pathways for Prosperity Commission set out to investigate how developing countries can respond to the effects of technological change. When the Commission started in January 2018, the risk of automation dominated global discussions. Would any jobs remain for humans in an automated world? Who would get these jobs? How would businesses distribute capital if robots became the key generators of profits? The Commission set out to offer new research and analysis with an eye on the broad picture of technological change, and to provide a platform for new ideas for possible ways forward. Through two years of research and consultation, the Commission has significantly expanded this important global discussion, and demonstrated that digital technologies bring many new opportunities. Digital technologies also bring risks that need to be managed, but these are more varied and nuanced than a simple case of job losses due to automation. Thus, the overriding message of the Commission is one of optimism. The stakes are high but so too are the potential benefits.

The Commission's analysis has significantly impacted the international narrative surrounding technology and development, shifting the tone from one of alarm to one of constructive debate. Beyond this, its work has also helped countries and policymakers approach the practical challenges of planning for digital transformation, through the creation of a <u>Digital Economy Kit</u> (described further in Box 2). This kit has been refined through pilots in Ethiopia, Mongolia and South Africa. A number of other countries are starting to adapt and use this tool to develop their own digital strategies. The Commission's engagement, consultation and outreach has extended from the start-ups of Bangalore to the nomadic farmers of Mongolia; from the government ministries of Porto-Novo to the conference centre of Kigali. These rich sources of evidence, analysis and ideas mean that the Commission can now, with some confidence, put forward a set of priorities and recommendations for inclusive development in a digital age.

It is no exaggeration to say that digital technologies are transforming the world. These tools – which range from machine-learnings to databases, SMS-messaging, mobile money, and robots – are mutually reinforcing, spurring an accelerating surge in new technologies and new applications of old technologies. During earlier periods of technological innovation, tools were developed for specific purposes (such as the piston steam engine for pumping water). Widespread use took place only over decades or centuries, and adaptive uses for different industries and uses emerged particularly slowly. Today, new machine-learning techniques can improve efficiency in all industries,

from accounting to robotic manufacturing, within a matter of years – or even months. Such progress is further compounded by, for instance, advances in communication bandwidth and better sensors for gathering data. The concept of real-time computer vision – the ability of computers to identify objects in images – was a field of abstract academic enquiry only a few years ago. Today, cloud computing service providers sell this as a commodity for just fractions of a cent.[1] Such improvement is happening at an exponential pace, and has been accompanied by rapidly falling prices over the past two decades. Many technologies that were once luxury goods, such as large hard drive storage, are now far more affordable (see Figure 1).

Figure 1. **The costs of many technologies – not only digital – are falling rapidly**

Cost per unit (USD, logarithmic scale)

- DNA sequencing (1 million base pairs)
- Computing power (1 GFLOP)
- LED light (1 kilolumen)
- Disk drive (1 GB)
- Wireless data transfer (1 kbps)
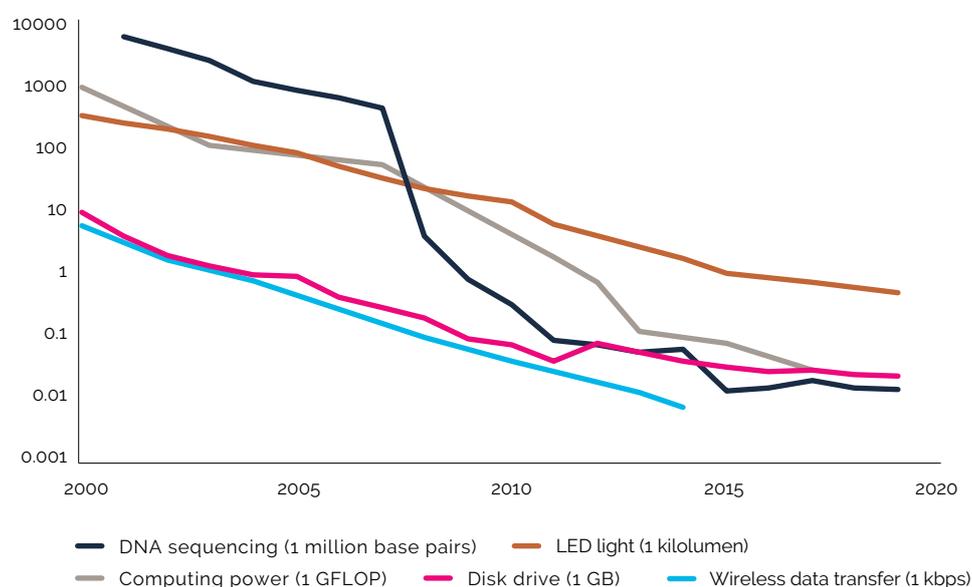
Sources: DNA sequencing data is from Wetterstrand (2019); hard drive storage data is from McCallum (2019); wireless data transfer data is from Nielsen (2018) and Tucker (2010); computing power data is from AI Impacts (2017); LED light data is from Haitz and Tsao (2011) plus 2019 prices collected by the Pathways for Prosperity Commission.

Throughout all the Commission's work, one finding has remained clear: technology-enabled growth is never just about the technology itself, but about how people, firms and governments respond to technological change. Our analysis identifies three mechanisms through which technology can alter economic and social systems (see Table 1). Technology can change how things are produced or delivered – for example, by increasing labour productivity through automation. Technology can change the way different actors connect to one another in systems, societies and markets – for instance, by using digital supply chain management to lower

logistics costs. And technology can change the fundamental design or architecture of a system – such as by enabling real-time collaboration between workers around the world. However, not every person in every place will experience these benefits. This is because the overall impact is determined not by the technologies themselves, but by the ability of people to take advantage of these technologies. Impact depends on whether the local environment creates conditions for firms and service providers to invest in – and profit from – new technologies, and whether and how any benefits work their way through the economy and society (see Chapter 2 for more on this).

Table 1. **Technology can change economies and societies at the level of production, connections and organisation**

What technology changes	Features of this change	Examples	Policy implications
Production How things of value are produced, or how services are delivered	How tasks and functions are performed, with a change in the division of labour between humans and machines	Personalised e-learning tools, additive manufacturing (3D printers), tailored agricultural advice to farmers	Global demand for low-skilled or unskilled labour may decrease with automation (it may be cost-effective to reshore); higher returns to investing in human capital; cheaper and easier to deliver services
Interconnections in systems and markets Exchanging information, goods, services, labour and capital	Changing the quality of connectivity in the systems and markets, boosting performance through better allocation of available inputs and resources	Ride-hailing apps, digital supply chain management for pharmaceuticals, platforms to connect farmers to better markets	Highly optimised supply chains mean small-scale firms can access large markets; many valuable services can be delivered virtually
Organisation The design and architecture of a system	New models for organisation and networking (how people, companies and governments interact)	Digital payment systems, online freelancing, proactive monitoring and adaptation of educational curricula	New global division of labour; data will improve decision-making in almost all contexts

For the first time in history, more than half the world's population have used the internet (see Figure 2) – but this is no time for complacency. More than 3 billion people remain unconnected. This is a stark reminder that digital technologies alone will never be sufficient for inclusive growth. What is more, many governments are disconnected from their citizens, and have little capacity to navigate the risks that come with digital technologies. The promises of digital technologies must therefore be digested with a healthy dose of realism. In previous reports, the Pathways for Prosperity Commission has identified opportunities and risks in specific areas: national economic transformation, the digital lives of individual citizens, the management of major health and education systems, and the international governance of digital technologies.[2] This *Digital Roadmap* summarises core lessons, and puts forward recommendations to help resolve some of the remaining barriers to inclusive growth for developing countries.

Figure 2. **Internet use is growing rapidly, but billions of people remain unconnected**
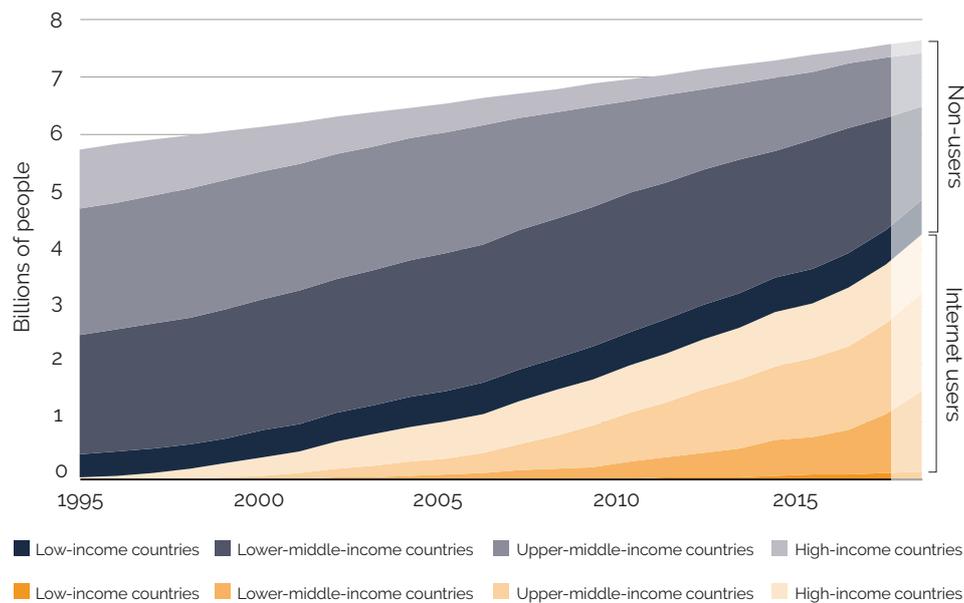
Source: International Telecommunication Union (2019); Pathways for Prosperity Commission analysis.

Note: country groups are based on income status in 2017; these categories are for the total population including infants and children; 2018 figures are estimated projections using the latest available data.

This report sets out a series of priorities for governments, businesses, NGOs, donors, and individuals to pursue. It begins by outlining the challenge of inclusive growth (Chapter 2) and why countries should develop a national digital compact with all stakeholders working towards a shared vision (Chapter 3). From there, it underscores the importance of putting people at the centre of any national digital transformation, ensuring citizens are both equipped to benefit from the opportunities offered by the digital age, and protected from potential harms (Chapter 4). It argues that for any of this to be possible, countries must build the necessary 'digital essentials': the infrastructure, platforms and capital required for digital technologies to take hold in society and the economy (Chapter 5). Of course, the poorest and most marginalised people will not automatically be included in the new opportunities presented by digital technologies. This report argues that reaching everyone will take concerted effort, with new business models for access, and new services deliberately designed for inclusion (Chapter 6). Finally, countries must govern technology for the future by developing dynamic, new approaches to service delivery and regulation (Chapter 7).
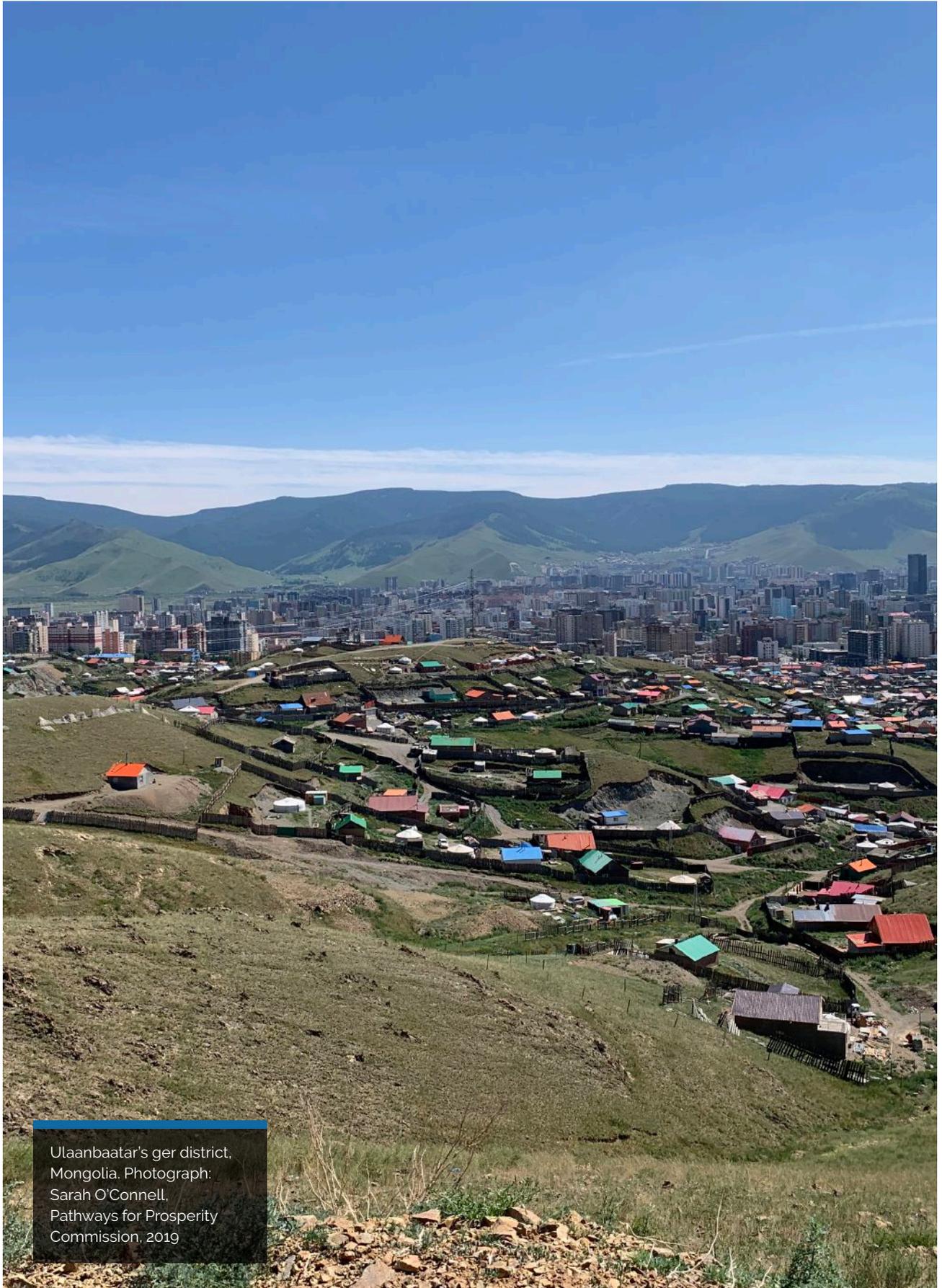
Ulaanbaatar's ger district, Mongolia. Photograph: Sarah O'Connell, Pathways for Prosperity Commission, 2019

Chapter 2
The challenge of inclusive growth

Technology has been a driving force for development for centuries.
The forces set in motion by the factory production line continued with railroads, (international) telephone lines and container ships. Today, digital technologies are powering robotic manufacturing, instantaneous communication, and new online services (see Table 1). Over the second half of the twentieth century, the cost of trade and communication fell by a factor of 20, allowing developing countries to join global markets, and lifting billions out of poverty.[3] China, along with other countries, most of them in East Asia, managed to take advantage of export-led industrialisation, which drove massive gains in living standards.[4] But this pathway to growth is closing. Technological change is reducing the scope for new countries to replicate the East Asian manufacturing success story of recent decades. Luckily, the current wave of digital technological change also brings new opportunities.

Despite current tensions in international trade, a new wave of global economic integration has begun, driven by new technologies that enable ever greater levels of interconnectedness. The impact of digital technologies is astounding. Even though almost half the world remains offline, hundreds of thousands of people are connecting to the internet for the first time every day. They are connecting to a new world of information, services and opportunities.[5] New technologies are revolutionising how economies structure their activities: for instance, additive manufacturing (3D printing) and internet-connected factory equipment are making it possible to dramatically increase the range (and the complexity) of industrial processes that are moved into global value chains. At the same time, high-bandwidth internet, videoconferencing and telerobotics are enabling a new global trade in services (see Box 1). Tasks that may require judgement, creativity, patience or technical expertise (such as accountancy or graphic design) no longer require the worker to be in the same country as the client. While the risks of labour-saving technologies receive considerable attention, with predictions of potential job losses in developing countries ranging from 9% to 80%, in reality, these estimates are no better than guesses.[6] They do not account for the new jobs that will be enabled by these same technologies, and they create a sense of fear and paralysis, without providing any guidance to decision-makers. The reality is not so bleak.

Despite this progress, growth depends on a number of factors, not technology alone. The countries that will benefit are not just those with technological capacity, but rather those that succeed in bundling technology with enabling policies and profitable business models.[7] Many countries are seeking to emulate the East Asian success story, which is often framed in terms of light manufacturing. In actual fact, manufacturing was only the first part of the story that began in the 1980s. Manufacturing provided an engine that also drove a move out of agriculture and into services, which experienced much larger growth rates, providing more employment and higher wages, and resulting in substantial poverty reduction.[8] Driving broad, inclusive growth with these same industries in new countries may not be possible today.[9] Current trends suggest that many (or indeed, most) of these jobs will be automated where they are, rather than relocated to new countries. And even if these light-manufacturing industries do move to new countries, the scale would have to be enormous to lead to widespread impacts. For example, to absorb the expansion in the African labour force between 2010–2030 would require most or all of the manufacturing jobs in China, India and Bangladesh combined (234 million).[10]

Box 1. **Global trade in services**

Digital connections are allowing for new modes of work with the potential to provide higher wages and greater flexibility to workers in developing countries. If harnessed well, these jobs could become a growth engine, absorbing labour at both the lower and higher ends of the skills distribution. The Philippines and India have already benefited from the growth in the global trade of services, which accounts for almost a fifth of global trade.[11] With the right investments in connectivity, an enabling business environment, and digital and soft skills development, other countries can grow their business process outsourcing (BPO) sectors, thereby reducing poverty and increasing growth.

There are already examples of countries and companies taking advantage of this growth pathway. In China, the global growth in machine-learning (and demand for labelled datasets) is creating opportunities for a new generation of low-wage workers in (relatively) small cities, where the cost of living is low. Such workers, for example, label vast collections of images and surveillance footage to manually identify objects such as cats, cars and people to train computer vision algorithms. In South Africa, following an opportunities workshop conducted by the Pathways for Prosperity Commission (as part of the Digital Economy Kit process, see Box 2), the BPO industry association, BPESA, announced its intention to double the number of jobs in the sector over the next five years, to capitalise on industry growth projections. In Mongolia, participants in a human capital workshop organised by the Pathways Commission identified globally traded services as an opportunity for economic diversification away from mining. In fact, a Japanese company recently recruited hundreds of Mongolian developers, who will contribute to its data-structuring and analytics business from Ulaanbaatar, demonstrating the potential for global trade in these services.

Some BPO jobs are susceptible to automation, especially those relying on codifiable tasks. This challenge, however, does not mean that countries need to focus solely on high-skilled tasks, but rather that the new BPO sector will leverage skills that require uniquely human traits such as creativity, empathy and human intelligence. Jobs such as elderly care, graphic design, remote counseling, and others that make use of these soft skills will become increasingly important in the globally traded services industry.

The Commission's first report described five technology-enabled pathways (Figure 3) that could help drive inclusive growth: raising value from agriculture; extending global value chains to include more complex processes (ie higher-value manufacturing); creating new global trade in services (see Box 1); linking the informal sector to the formal economy; and creating diverse and connected domestic economies.[12] Importantly, many of these pathways are predicated on opportunities beyond labour-intensive manufacturing. Instead, these pathways build engines of increased productivity to drive broader opportunities across the economy, and open up new markets for people at the bottom end of the income distribution. Echoing the framework in Table 1, these pathways harness technology in different ways to stimulate investment and growth. Some use digital technology to make existing production processes more efficient (eg raising value from agriculture, or automating production processes). Others use digital platforms and other tools that enable more efficient exchange (eg linking the informal sector to the formal economy). Still others use advanced communications and data analytics to completely change how work is organised (eg the global trade in services).

Figure 3. **Five technology-enabled pathways for inclusive growth**

Unleashing value from agriculture

The next version of global value chains in manufacturing

Diverse and connected domestic economies

Global trade in services, including based on human interaction

Connecting the informal economy
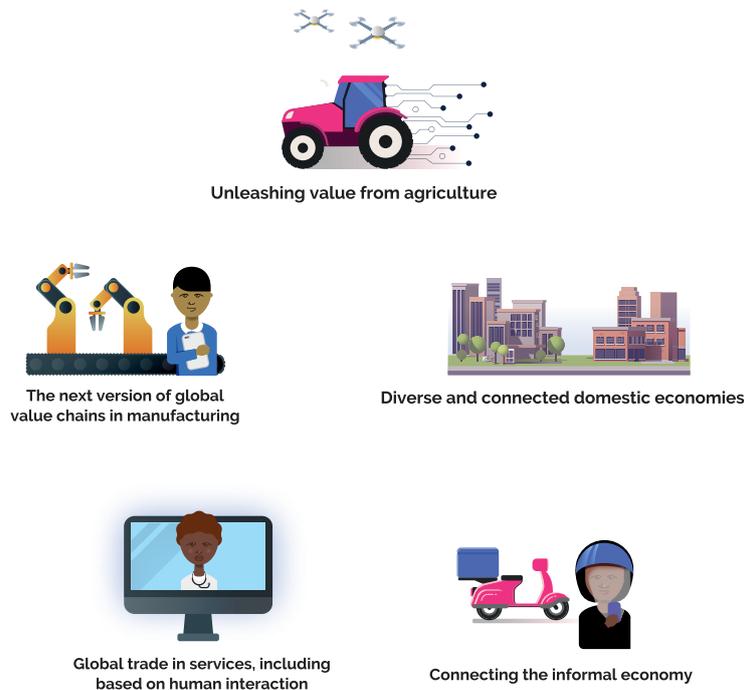
To ensure digitally led growth opportunities include as many people as possible, the right arrangements must be in place – in terms of both domestic digital readiness and international technology governance. How this plays out in the real world is dependent on a complex web of factors. It would be naive to ignore the realities of trade negotiations, the interests of multinational firms, and global market dynamics. Developing countries do not have access to all the levers needed to guarantee inclusive growth. And yet, digital technologies present tremendous opportunities to support inclusive development. Tapping into this potential will require new thinking on the role and responsibilities of the state in development, as well as a reimagining of the role of private companies in contributing to collective prosperity in the digital age. Past periods of technological change and global economic integration have not led to inclusive growth across the board. Indeed, in many places, the current wave of technological change is predominantly delivering benefits to those who are already well-off. Meanwhile, less-advantaged groups do not use or benefit from digital tools – and so, existing inequalities can become deeper and more entrenched. Without creativity and an appetite for new approaches to the governance and management of such forces, societies will continue to exclude the poorest, leaving billions behind.

12-year-old Basanti uses an online educational tool, Udaipur, Rajasthan, India. Photograph: Ishan Tankha, Pathways for Prosperity Commission, 2018

Chapter 3
Craft a digital compact for inclusive development
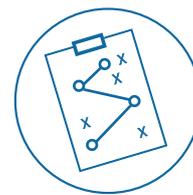
Embracing digitally led economic change will be disruptive, and navigating it requires coordinated action across society and the economy. There are important trade-offs to navigate as economic transitions create both winners and losers. New business models and technologies may disrupt incumbents. For instance, creating digital marketplaces and automated logistics platforms could threaten existing trading and freight companies. Reconfiguring an economy will inevitably meet with some, at times justified, resistance, even when reforms are pursued for country-wide gain. The best way to achieve the necessary buy-in across sectors, and to balance trade-offs is through considered dialogues with stakeholders: representatives of the private sector and civil society in its broadest sense (including community leaders, academia, trade unions, NGOs, and faith groups). These people will have interests at stake, and have important roles to play in creating the future. Past experience clearly shows that the political economy of upheaval is fraught, and reform is best managed when all stakeholders are part of the discussion.[13]

Ideally, the end point of these dialogues should be a national digital compact: a shared vision of the future to which government, civil society and the private sector commit. This compact would take different forms in different contexts; it could be a set of generally agreed goals, or it could be a detailed package of binding commitments. The fundamental concept is to articulate a shared vision that all parts of society can rally behind as they see their interests reflected in it, rather than a vision that alienates one group to please another. Such a vision would encompass the sorts of priorities outlined in later chapters of this report: initiatives to build human capacity, improve service delivery, reach those left behind, and grow local entrepreneurship. No government can achieve this alone: some significant aspects of this vision would require leadership from civil society, the private sector and donors.

If a compact can be formalised and made explicit, the likelihood of all parties honouring their commitments increases. A shared political vision between stakeholders is helpful in theory, but achieving the best results will require a detailed plan of action. Codifying a compact in a formal digital strategy will add value beyond simply writing out a plan or policy matrix. When done well, this will also create a platform to attract investment and a means to hold people accountable. The Pathways for Prosperity Commission has supported three countries – Ethiopia, Mongolia and South Africa – in the process of developing

a country-wide digital strategy, and developed a kit as a guide to others (see Box 2). The Digital Economy Kit provides a framework to organise analysis, dialogue and planning around core technical barriers to digital transformation. With such a strategy in hand, and the backing of civil society and industry, developing countries can avoid missing out on the next wave of globalisation and inclusive growth.

Box 2. **The Digital Economy Kit: crafting a national strategy in Ethiopia, Mongolia and South Africa**

The Digital Economy Kit offers guidance for countries looking to create a national digital strategy for inclusive growth.[14] The kit breaks the process into three stages:

1. Assessment **2.** Dialogue **3.** Strategy formulation

The kit presents core issues countries must consider to achieve digital-led development, including digital infrastructure, human capital, available finance, and the regulatory environment. It also emphasises the importance of a country-led and country-owned process, based on each country's goals for inclusive growth.

The pilot countries – Ethiopia, Mongolia and South Africa – had different goals for digitally enabled growth, which informed each stage of the process. For instance, South Africa focused on job creation as the primary goal, while Mongolia focused on economic diversification and sustainability. In each of the pilot countries, the dialogue process involved stakeholders from government, civil society and the private sector. These dialogues took various forms, ranging from problem-solving workshops in Mongolia, to bilateral stakeholder engagement in Ethiopia, to a blend of the two in South Africa. Participants debated the bottlenecks to the adoption of technology in the economy, as well as to digital access and usage. Together, participants agreed on priorities for strategic action.

For each of the pilot countries, the Commission's local partners sought to embed the resulting strategy into existing political processes. In South Africa, the draft strategy work was tied into the President's Public-Private Growth Initiative (PPGI). In Mongolia, the strategy was produced in partnership with the Cabinet Secretariat, who accepted the draft strategy and assessment and plan to use it to draft new laws and propose new large projects for investment. In Ethiopia, the Ministry of Innovation and Technology (MInT) will submit the strategy to the Council of Ministers (Ethiopian Cabinet).

For the private sector, being part of a digital compact brings benefits and responsibilities. Effective planning for new opportunities from digitalisation requires the inclusion of business and industry in a strategy-forming process. Their buy-in will increase the chance of successful implementation. But more important than consultation per se is the private sector's enthusiastic understanding and acceptance of its role: it must contribute to the digital compact, too – for instance, by funding apprenticeships, accepting greater competition, or complying with mandated minimum service levels. Firms across the economy will, in aggregate, benefit from these sorts of measures by having access to a more skilled workforce and a wealthier customer base. Despite these shared benefits, all firms have an incentive to be free-riders – benefitting from the investments of others without contributing themselves. However, a compact creates a political and social mechanism for compliance; if industry leaders are included from the beginning, they are more likely to both adhere to and champion the shared vision for the future.

For governments, the digital compact gives assurance that other actors will support the plan, and it creates a mandate for action. Governments have the largest role in steering technological change towards inclusive development outcomes. This requires political will and a willingness to allocate significant resources that can survive across elections or transitions of power. Both will be easier to maintain with the knowledge that stakeholders across the economy and society not only endorse the plan, but are ready and willing to contribute. Of course, government bureaucracies are notoriously byzantine, and stakeholders may not trust that officials can (or will) deliver on a digital compact. The government side of a compact must be championed by senior government leadership, people with authority and resources to be agents of transformation. It cannot be driven by a technical ICT agency alone.[15] Experience from countries around the world has shown, time and again, that technological transformation must be driven from the centre of government.[16] In practice, this could mean placing responsibility for digital transformation with a senior cabinet minister, or, as Mexico and Peru have done, creating special cross-sector coordination groups of ministers and bureaucrats.[17]

A national digital compact coordinates action across all facets of the economy, society and government policy, but it is not a prerequisite for action. The benefits of a shared national vision should not be discounted. Leaders and decision-makers can take action knowing that they are contributing to something bigger; donors and philanthropists can read it as a signal that states are serious about digital transformation. Indeed, the components of a well-articulated digital compact should be priorities for technical and financial support from the global community, such as UN agencies, the World Bank, development finance institutions and donors. These actors often pursue their own individual priorities in a piecemeal and disconnected fashion, lacking the coordination required for transformative digital change. National compacts can remedy this. Technological change will almost always benefit early adopters and people who already enjoy wealth and power, but with a national digital compact, countries can leverage

technology for all. However, despite these benefits, a national digital compact should not be considered a strict prerequisite for action. Implementation of the sorts of individual initiatives detailed in the rest of this report can and should proceed, even if local factors make it difficult to pursue such a compact.

Recommendation 1

Governments, civil society and the private sector should work together to forge a national compact for inclusive development in the digital age: a shared understanding between key stakeholders to coordinate on complex trade-offs. **Donors, philanthropists and multilateral organisations** should support country initiatives that are backed by such a political compact, rather than pursuing piecemeal and uncoordinated priorities.

Recommendation 2

All parts of **government** – particularly central economic and planning ministries – need to be involved in policymaking addressing technological disruption. Countries should avoid relegating broad digital transformation to technical agencies with only a narrow mandate.
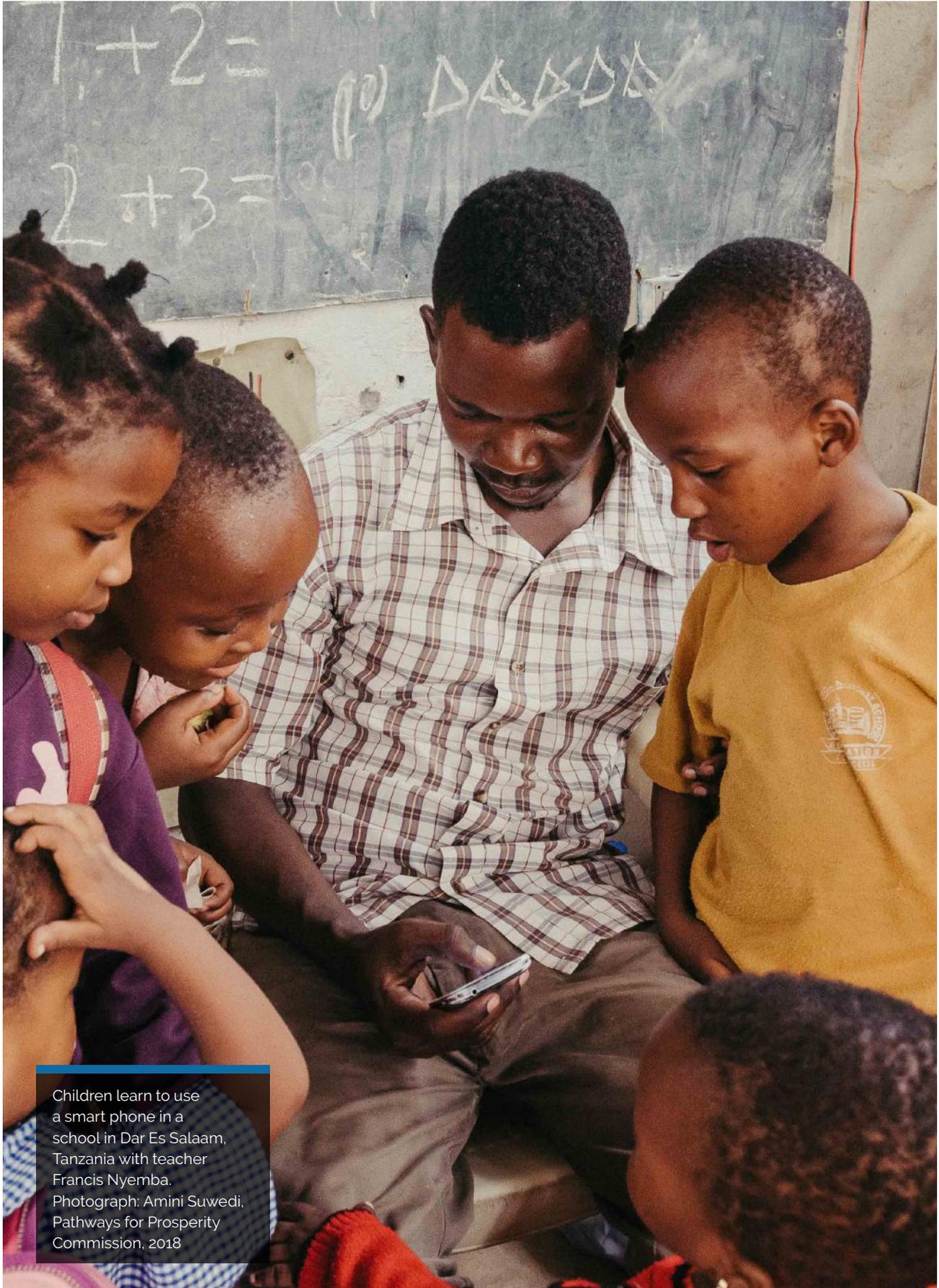
Children learn to use a smart phone in a school in Dar Es Salaam, Tanzania with teacher Francis Nyemba. Photograph: Amini Suwedi, Pathways for Prosperity Commission, 2018

Chapter 4
Put people at the centre of the digital future

It is important to remember that although the idea of rapid technological change may seem abstract, such change ultimately affects the lives of real people. The digital compact described in Chapter 3 must be more than a tool to boost private sector innovation, to source funding for infrastructure investment, or to connect people to the internet as an end in itself. The answers to other questions are just as important. What people are being connected to? Does the vision of the digital future meet people's needs? Can the digital future envisioned improve their livelihoods? Failure to put people at the centre of social and economic change can lead to dissatisfaction and unrest, manifesting in slow growth, or even violence. The pace and intensity of technology-enabled change will make it all the more important for leaders to ensure that the digital future is one with people at the centre.

Putting people at the centre of digital transformation means equipping them to benefit from the opportunities, and protecting them from the potential harms of the digital age. To take advantage of the new opportunities offered by digitalisation, people will need relevant skills and knowledge. They also need opportunities for their voices to be heard. A digital future that puts people at the centre is one in which digital technologies enhance, rather than diminish, the relationship between citizen and state. Citizens will also need to trust that the digital systems of the future are safe, transparent and accountable. Even so, some people will inevitably be left behind. Social protection is needed to minimise any potential harm to individuals or families in the transition to a new economy and society. Digital technologies can make the provision of such protections more efficient and effective. These new technologies will transform every aspect of people's lives. It is important that this transformation is designed to be inclusive.

4.1 Equip everyone with the right skills for digital opportunities

Technological change creates an imperative to ensure that workers and entrepreneurs have the skills and abilities to take advantage of new opportunities. Digitally enabled growth that only provides jobs for the top tier of society is unlikely to lead to broad inclusion. On the contrary, it may entrench existing inequalities. Many developing countries – across Africa, in particular – are facing an employment crisis: 85.8% of people work in the informal economy or are underemployed.[18] Despite widespread underemployment, firms across

Africa report a mismatch between their needs and skills of jobseekers. In Kenya, 26% of companies surveyed highlighted skills mismatch as a major operational constraint.[19] This is partly due to the rapid nature of technological change; predictions about what skills will be needed in a few years' time are hard to make. Even in more developed countries, a focus on new careers (such as coding) may obscure broader labour market changes.[20]

For almost all digitally enabled development pathways, people must be provided with a baseline level of foundational education in literacy, numeracy and digital skills. Basic literacy and numeracy are a prerequisite for many new technological interventions. Beyond this, basic digital skills, such as browsing the web or using mobile phones, are increasingly important.[21] Such skills can enable people to independently find or verify information (for example, they may be able to fact-check claims about the quality of goods for sale), or to connect to larger markets (as with the Twiga platform for farmers in Kenya).[22] Despite this, digital skills appear to be lacking in many places. Our analysis of data from seven developing countries shows that, while almost everyone can make a phone call, less than a third are able to use more sophisticated digital products, such as social media or digital finance.[23] Investing in this basic human capital should therefore be a priority for all countries, as part of the compact described in Chapter 3.

Inflexible and out-of-date vocational curricula need to change, with more dynamic involvement of the private sector, to provide technical, job-specific skills. Technical and vocational education and training (TVET), often seen as a solution to industrial disruption and skills gaps, rarely remains relevant to industrial requirements. In South Africa, funding goes to accredited but inflexible courses that are out of sync with employers' needs, and there are similar issues in Ethiopia and Kenya.[24] Government resources enable training schemes to operate at national scale, but these resources are wasted when invested in poorly designed schemes. Outcomes for training recipients remain mixed, with modest, if any, impact on employment or wages.[25] Therefore, it is perhaps no surprise that many companies are choosing to sidestep TVET schemes, and deliver their own training programmes. For example, in Kenya, CloudFactory employs local people to perform microtasks (such as data entry or image-tagging to train machine-learning algorithms) for clients around the world. New employees must have a basic level of general skills (such as the ability to use a computer), but they also receive specific, on-the-job training.[26] In India, a similar business, iMerit, recruits employees from disadvantaged backgrounds from its sister charity, the Anudip Foundation's community upskilling programme.[27] However, such programmes seem to be the exception, rather than the norm: most workplaces do not offer any skills training.[28] To increase companies' involvement and boost TVET relevance, government agencies should work closely with the private sector to design curricula that include apprenticeships, and, ideally, lead to employment. In China, for example, a public-private partnership helped to train people in marginalised communities to participate in new industries.[29] Where governments are unwilling or unable to reform their TVET systems, NGOs and the philanthropic sector should take the lead in new partnerships.

Transferable, adaptable skills will also be increasingly important, alongside technical, job-specific skills. Given the uncertainty as to what the future holds, it makes sense for people to build skills that are resistant to automation and change, in addition to training for a single, specific job.[30] In every sector, the skills that cannot be easily automated or codified – 'soft skills' such as empathy, teamwork, creativity, judgement, and communication – will increasingly be in demand.[31] The Commission's South African dialogue process (see Box 2) included input from NGOs that run work-readiness training to bridge this gap, by partnering with private firms who see them as recruitment platforms. The NGOs offer unemployed young adults (or sometimes students close to finishing school) training in 'work-ready' skills such as critical thinking, digital skills, time management and accountability.[32] These programmes can be effective, but the best times to develop socio-emotional soft skills are during early childhood and primary schooling. With this in mind, education providers must adapt to help facilitate these soft skills among the population over the long haul.[33] Indeed, preschool programmes in Ghana and Zambia found that including activity-based soft skills training led to the best learning outcomes.[34] Scaling up such programmes may require broader cultural change, as parents often still expect a rote-learning, 'pass-and-forget' style of education.[35]

Box 3. **Educational systems of the future: personalised, proactive and continuously learning**

Smart investment in technology for education can help provide quality learning to everyone, everywhere. In *Positive Disruption: health and education in a digital age*, the Commission outlined future visions for inclusive educational systems enabled by new technologies.[36] Personalised and proactive systems constitute a bold vision that is increasingly within reach. Such systems will be made possible by adaptive software that provides lessons tailored to each learner's needs. Such software pinpoints the topics a given student does not understand, and identifies at-risk students in need of additional attention. In India, for example, the Mindspark adaptive learning software has been introduced in public schools. It helped to improve mathematics scores by 38% in less than five months, and was estimated to scale up for only US$2 per student per year.[37] What is more, such software has the potential to improve education for girls in particular. In Malawi, for example, onebillion's 'onecourse' was found to prevent a gender gap in mathematics learning amongst first graders.[38]

The impact of digital technologies in education is stronger when they are integrated into teachers' practice and the wider system.[39] Their highest added value might be not in merely moving education online, but rather in providing an unprecedented opportunity for educational systems to adapt and improve in real time. While some current systems (such as Tusome, a Kenyan programme that includes digitised teaching materials and a tablet-based teacher feedback system), help teachers to continuously improve their practice, a true learning system would also involve managers and decision-makers, improving how the entire system is run, in an adaptive way. For this, better data flows are crucial. In India, the Visiting Information of Schools Handled with Attendance System (VISHWAS)

programme collects GPS-linked, time-stamped data on a variety of indicators from student and teacher attendance to test results and even free meal provision, in over 1,600 schools. The programme helps to prevent absenteeism among teachers and inspectors, and improves both teaching and management practices.[40]

Digital technologies can provide new avenues for people to learn new skills and adapt to a changing labour market. Digital education tools (see Box 3) may help improve standards by giving real-time feedback on performance, creating tailored learning experiences, or taking cues from external data.[41] With today's technology, it is no longer necessary to wait for a once-in-a-decade review to set the next curriculum, as courses can be adapted more easily and more quickly. This flexibility does not just apply to school curricula, but to adult training as well. Instead of necessitating enrolment in a six-week, onsite course at a TVET institution, skills training could be conducted more flexibly online, such as through the Funzi platform, which provides online modules for professional skills.[42] It is in everyone's interest that a digital compact based around new economic opportunities is underpinned with the investments in human capital that are needed to seize such opportunities. With the right, people-centred approach, citizens can gain the necessary skills to deal with economic upheaval, unlocking their potential to participate productively in the digital age.

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Recommendation 3

Governments should take responsibility for ensuring that vocational education is truly useful for workers and for business in the digital age. They should work with the **private sector** to keep curricula up to date, using their policy levers of accreditation and subsidies to support new forms of lifelong training.

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Recommendation 4

The **private sector** should provide on-the-job training and apprenticeship programmes at scale, doing their part for the national digital compact by contributing to skills upgrading across the economy.

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Recommendation 5

To cope with rapid change, **governments** should ensure that their citizens – especially children in school – are developing flexible skills, including transferable socio-emotional soft skills, which are complementary to new technologies. **Private-sector** support for general work-readiness programmes can augment such efforts.

4.2 Create a safe digital world where people's voices are heard

If people are to be at the centre of economic and social change, citizens must be prepared for disruption, protected from risks, and participating in decision-making. In practice, this means governments and service providers must engage with citizens, understand what they want, and have clear incentives to deliver it. A first step is to make sure that information on government performance is publicly available by default – as in Brazil's Transparency Portal (which publishes budget allocations) and Slovakia's legal requirement that all public procurement information is published online.[43] To truly ensure transparency, data must be easily accessible, standardised and machine-readable. Even then, citizens are unlikely to directly engage, particularly in countries with low levels of literacy and internet penetration. Thus, civil society organisations, the press and other media outlets – and the funders that support their efforts – are vital in disseminating relevant, accurate information.[44] Information and transparency can have positive impacts in places where public debate is dominated by ethnic or patronage politics, catalysing a shift towards voting based on outcomes and steering political discourse towards the quality of citizens' lives.[45]

A stronger citizen-state relationship would go beyond providing open data, and create methods for citizens to be heard. Digital technologies have made it easier to communicate at speed and at scale. In turn, civic activism has gained momentum, bolstered by better knowledge of rules, better availability of evidence, and instantaneous communication.[46] Some government leaders view these new avenues for expression as a risk to their political model (and indeed, there is also the clear risk that these technologies can be abused to spread misinformation or foment unrest).[47] However, leaders can also view the widespread use of digital platforms as an opportunity: such platforms can help identify and resolve problems. For example, no good government intends for programme funds to disappear through graft or incompetence, and citizens can help identify these issues. Initiatives such as Por Mi Barrio in Uruguay, I Change My City in India, Lungisa in Cape Town, and Majivoice in Nairobi all provide channels for citizens to raise complaints or problems with service delivery, which can lead to better outcomes.[48] Similarly, in Kenya, Ushahidi digitally gathers information about citizen experiences – for example, about the conduct of elections – that can spur follow-up by the media, civil society organisations and government agencies.[49] When given relevant information, a voice, and an active feedback loop that demonstrates results, people will be much more likely to demand the services and governance they need.

In an age of unprecedented centralisation of data about citizens, it is important to establish data governance frameworks that are secure, transparent and accountable. Many of the proposals in this report involve using digital technologies to administer systems more efficiently. Such tasks require gathering and holding a significant amount of information about individual citizens. While the potential for benefit is large, so too is the potential for harm. Mass information gathering is only one step

removed from deliberate surveillance, which can not only lead to discrimination and coercion but can also harm 'intellectual privacy', leading people to self-censorship. There are clear examples of both governments and firms abusing the power granted by the information they hold – often in ways that citizens neither expect nor agree to.[50] Even when not leading to deliberate abuse, policies such as mandatory data monitoring and internet shutdowns can dampen citizens' willingness to use digital services.[51] Policymakers should act within their social license, designing digital governance frameworks that reflect society's expectations of transparency and accountability – detailing how data will be used and handled, and incorporating concerns for users' (cyber)security, agency and human rights. People should have a level of informed consent regarding the collection and storage of their information, knowledge of how it is being used, and avenues for redress if they believe their interests are harmed. Government modernisation and automated decision-making should not be a cover for the erosion of due process.

Intentional abuse of data is not the only risk – data governance frameworks should also manage risks of accidental breaches. Data breaches and other cybersecurity incidents do not only happen in ineffective or exploitative bureaucracies – well-resourced international and UN programmes have also failed on this front.[52] If policymakers rush too quickly into digitisation, they put the privacy and safety of citizens at risk. This is not to say that countries should not digitise services, but simply to underscore that a critical prerequisite is to have appropriate data governance frameworks in place. For example, simply encrypting a patient's digital ID may not maintain a citizen's anonymity if they can be identified by metadata from other sources (such as geolocation from a phone). The necessity of appropriate governance frameworks also extends to decisions made by algorithms. Concerns over algorithmic error and bias are currently at the centre of significant discussions in the United States and Europe, but these issues are even more important in developing nations, where the quality of data feeding these algorithms is lower, and existing patterns of discrimination are more pronounced.[53] If left unchecked, the use of machine-learning and other automated decision-making tools could result in significant harms for some groups.[54] Firms can guard against this by regularly retraining and auditing their algorithms as they gather new data or as the 'ground truth' of reality changes over time. But, more broadly, citizens should be able to easily defend their interests against the reasoning of an algorithm, just as they should be able to appeal the reasoning of a human. Governing data in ways that are secure, transparent and accountable, and empowering citizens to use their voices to shape government priorities will go a long way in building a future with people at the centre.

Recommendation 6

Governments should provide open information about their programmes. At a minimum, provincial and national governments should publish (in digital, machine-readable formats) administrative data and information about budget allocations. **Civil society organisations and donors** can complement this by funding initiatives and communicators to translate such data for citizens.

Recommendation 7

Civil society, governments, donors and philanthropists should actively invest in digital platforms designed to involve citizens in decision-making, and ensure their voice is heard in public decisions.

Recommendation 8

All **governments** need to establish a data governance regime. These should reflect their society's norms and expectations. Though there is no single blueprint, a common standard should be that citizens can trust that their personal information is collected and used in ways that are secure, transparent, and accountable, and that the governance regime demonstrates respect for fundamental human rights.

4.3 Support those who do not benefit from technological change

A people-centred digital transformation needs to include support for those who might be left behind. The pathways for digitally enabled growth (described in Figure 3) are not about betting on new high-tech innovations, but rather mostly depend on putting proven digital tools – and the skills to use them – in the hands of individuals and businesses. However, even when developing countries put forward credible and achievable visions, it is unrealistic to assume that every person will immediately benefit. People who are not part of these new pathways – particularly those workers who remain in the informal sector – could remain in poverty for years or decades before growth works through the rest of the economy.[55] In the Commission's digital economy dialogues (see Box 2), participants raised the issue of 'digital shocks'. In the event of mass automation in their industries, what would happen to hundreds of thousands of petrol station attendants or to quarry-workers? In the short term, these people may stand to lose out as a result of technological change, although society and the economy more broadly may reap benefits. If society shares in the benefits from digitisation, so, too, should it share the risks. Beyond this simple moral obligation, support for those left behind would also create the political space to strive for the economic and social reforms highlighted in this report.

There is broad international agreement that all people should have access to social protection when they need it; but in practice, this has been a difficult goal to achieve. Many forms of social assistance exist, including cash transfers, tax credits, public pensions, public works programmes, retraining, food rations, subsidies, and various social insurance schemes that rely on contributions from citizens (for example, contributory retirement pensions). Evidence from around the world highlights the benefits of welfare provision in the form of cash transfers in particular – with second-order benefits such as healthier families and better-educated children.[56] Indeed, the International Monetary Fund (IMF) has argued that social spending is critical for inclusive growth.[57] Ultimately, the benefits incurred by effective spending on social protection should be seen as a national investment, as opposed to merely a public expenditure. Despite a broad consensus on its benefits, less than half the world's population is covered by some sort of social assistance, and such coverage extends to only 17% of the population in low-income countries.[58] Lower-income countries also face significant challenges when implementing protection schemes. Analogue delivery channels – in which cash or other in-kind support must pass through layers of bureaucracy – can have high administrative costs, and can be prone to 'leakage' through corrupt officials.[59] In cash transfer schemes (particularly temporary programmes, or programmes that monitor recipients), administrative costs can sometimes absorb more than half of all expenditures.[60] Such issues inevitably reduce the effectiveness of schemes in reducing poverty.

Technology-driven economic shocks reinforce the need for social protection. At the same time, digital technologies can make these schemes more effective by expanding coverage, improving cost-effectiveness, and reducing leakage. In later sections of this report, we explore in detail how digital technologies can facilitate the inclusion of citizens in formal systems (see Section 7.1). Technologies such as digital identification, biometric data, digital payments and GPS are also enabling countries to build automated social protection systems. In these systems, transfers can be sent directly to beneficiaries, rather than via a chain of officials – reducing opportunities for corruption, misallocation of funds, and payment delays.[61] Mobile payments can also reach informal workers, such as subsistence farmers or street-side sellers – extending benefits to those in the grey zone outside the formal economy.[62] In Kenya, GiveDirectly has provided unconditional cash transfers via the M-Pesa mobile money service, reaching people without formal bank accounts.[63] Such direct transfers significantly reduce costs. For example, when Brazil's Bolsa Familia conditional cash transfer programme switched its payment system to electronic benefits cards, administrative costs decreased from almost 15% of grants to less than 3%.[64] Moreover, the data from digital systems can help governments better target their assistance. In the humanitarian relief sphere, the World Food Programme's SCOPE beneficiary management platform uses its operational data to understand trends and emerging needs, enabling real-time, data-driven decision making in its assistance programmes.[65]

There are still difficult questions to answer when allocating scarce resources, but social protection must be an important consideration during national dialogues. Social protection can be much more diverse than simple cash transfers, but the confluence of significant labour force upheaval with the ability to deliver benefits more efficiently than ever before makes cash transfers an important consideration for a national digital compact. The ideal policy will vary from country to country, with different approaches for how to deliver and fund services, which groups to target, and whether obligations should be imposed upon recipients.[66] Targeting payments (for example, to groups such as children, or people in extreme poverty) is a popular way to ensure that funds only go to those most in need, but screening beneficiaries can be administratively costly. Some countries may pursue universal basic incomes (a flat-rate, unconditional cash transfer to every citizen), to avoid the cost of administrative screening and decision-making.[67] Alternatively, a near-universal transfer may be implemented with the payment value tapering to zero once the recipient's income reaches a specific threshold.[68] Others still may prefer to provide one-off payments, or, perhaps, retraining grants, to deal with shocks. There is clearly no one-size-fits-all solution, but to the extent that countries want to take advantage of digital technology to provide social protection, the most crucial debate is likely to be how to fund it. The old 'Bismarckian' model, which determines benefits based on social security contributions, is unlikely to work in a future in which many (or most) people do not have a traditional job.[69] Transfers could, for example, be funded through taxation on successful sectors, and framed as a direct 'dividend' to citizens.[70] Less revolutionary approaches will still likely need to be funded through fiscal trade-offs: raising taxes across the economy, or scaling back other programmes and spending areas.[71]

Recommendation 9

Governments, with at least initial support from **donors**, where relevant, should strengthen their social protection programmes to support the poorest and those left behind by new economic opportunities – taking advantage of new technologies to cheaply and efficiently deliver support.

A young boy reads with
a solar-powered lantern
in India. Photograph:
Ishan Tankha, 2019

Chapter 5
Build the digital essentials

Digital technologies offer great opportunities for developing countries to pursue inclusive growth, but they require having specific essential components in place. In Chapter 3, we discussed how inclusive digitally enabled growth will require a national digital compact. This compact will only be possible if the basic digital essentials are in place. Digital products and services cannot be created in a vacuum; they require a broad ecosystem of enabling tools. This idea is not unique to digital sectors. A manufacturing industry needs roads and supply chains to transport its inputs; hospitals need equipment and medicine; and tourism hotspots need a nearby airport. In theory, enterprises can try to create everything they need: *a luxury* tourist destination might build a helipad, or a *highly profitable* mine might build its own railroad. But this is a path to exclusionary growth with little spillover. Instead, the adequate provision of the essential components required to support digital enterprise – on reasonable terms – should be considered to be in the public interest. Having the right digital essentials in place will better enable entrepreneurs to create profitable services, and provide benefits to society more broadly.

This chapter focuses on three key digital essentials above all else: physical infrastructure, foundational digital systems (such as digital identification and mobile money), and capital to invest in innovation. These provide the basic ingredients needed for existing firms to adopt more productive technologies, and for digital entrepreneurs to build and innovate. Having these essentials in place means that firms can focus on their core business. Some of the most successful digital firms are predicated on placing a simple innovation on top of extensive, existing systems. For example, e-commerce takes existing payment settlement, freight, customs, and delivery systems, and adds a simple discovery layer on top to match buyers and sellers. However, such innovations are dependent on having the essentials in place. Therefore, to enable future digital-led growth, these components must be priorities.

5.1 Invest in basic physical infrastructure for the digital economy

Physical infrastructure, such as telecommunications networks and a reliable electricity supply, is a fundamental requirement for an inclusive digital society, but one which remains lacking for many people. Reliable energy and high-speed internet services enable a whole range of economic options, as well as the potential for innovative and inclusive public service delivery. Indeed, recent evidence has highlighted how the arrival of fast

internet in a country can presage growth in output and employment.[72] However, around the world, almost 1 billion people currently lack electricity, and even more are not connected to the internet.[73] This featured prominently in the Commission's toolkit dialogues in Mongolia and South Africa (Box 2). In Mongolia, the ger (yurt) districts on the city outskirts have intermittent electricity supply; in South Africa, the system is under strain, with power outages and load shedding on the rise.[74] In both cases, this affects the plans of digital (and other) firms. The lack of these services impacts on development indicators (including health, gender equality, and poverty reduction), holds back agricultural progress, and limits investment in local businesses.

Advances in technology are creating new types of infrastructure and new opportunities for internet connectivity, bridging gaps for more remote regions. In remote locations, infrastructure costs can become too high for traditional networks to be viable. The main difference in cost structure for remote areas is backhaul (the connection to the main network), which is over four times more expensive than in urban areas.[75] However, new technologies are on the horizon. Remote regions can now be connected via satellite, and new lower-cost satellite deployments hold some promise for improving the relatively limited performance and high fees of satellite-delivered broadband services. Non-permanent structures such as drones and high-altitude balloons also offer potential new options for access beyond existing networks. For example, Loon, a sister company of Google, has partnered with Telkom in Kenya to trial using high-altitude balloons to provide internet connectivity to remote villages.[76] The company also partners with local telecommunications services to provide emergency internet connectivity following natural disasters. For example, following Hurricane Maria in Puerto Rico, Loon reportedly connected 250,000 people.[77] C-Squared, a broadband infrastructure provider in Uganda and Ghana, is building metropolitan fibre and shared-access backbone networks, helping local service providers deliver broadband services. Defraying the costs of backhaul investment can also be achieved with new business models, rather than through new technology, by aggregating demand among public buyers who want to reach marginalised and remote people. If government and NGO programmes pool their demand, and guarantee a market, the scales on a business case may tip towards network expansion.[78]

Perhaps because of its foundational nature, physical infrastructure constitutes a significant part of the digital development discussion. While telecommunications infrastructure accounts for only a small proportion of aid budgets, and funding gaps remain, physical infrastructure accounts for a large proportion of private financial flows.[79] Indeed, the energy and ICT sectors absorb more than two-thirds of private infrastructure financing to developing countries.[80] This makes sense: these projects are capital intensive – and without digital infrastructure, very little else is possible. That said, it is important to be clear-eyed about what else is needed, and recognise that the work should not simply stop at building cables and antennas. As discussed in Section 6.1, data from the International Telecommunication Union suggests that most people – even in the poorest countries – already live under a cell phone

signal. The challenge is therefore to ensure that everyone can afford access to the services provided by this infrastructure. Before moving on to this discussion, the rest of this chapter considers other essential components required to build digital industries and opportunities.

5.2 Create foundational digital systems

Fostering a diverse digital industry, with a rich offering of useful products and services, requires the right foundation of soft digital infrastructure: data standards, microservices, interoperable systems, and interconnections between databases.[81] Very few digital tools operate in a vacuum, and the smoother the connections between them – as exemplified by accounting software linking to a bank account, or crop analytics automatically pulling weather data – the more efficient digital tools will be. There are many examples of this around the world: IndiaStack provides a set of application programming interfaces (APIs) for civic services (eg identification, authentication, payments transfer), and Estonia's 'x-road' interoperability platform is used by over 2,300 public and private services (including online voting, prescription requests, and tax reporting).[82] Unfortunately, many developing countries lack basic digital microservices, such as GIS (geographic information system) data, or textual mapping for local languages.[83] The International Telecommunication Union and the Digital Impact Alliance have started to build up a strategic framework for investing in these digital microservices (see their identified priorities in Figure 4), and their work provides a sound roadmap for coordinated investment by the private sector, donors, development banks and governments.[84] National governments can foster this broad ecosystem of interoperable services by encouraging open standards, developing civic APIs that connect government services, or mandating that competing services must be interoperable.[85] While a broad ecosystem of microservices is useful, two specific foundational systems are of prime importance for all countries: digital identification and digital payments. Digital identification provides the backbone of digital participation, while digital finance is a crucial tool for individual participation in the digital economy, and can unlock new business models. Both can provide lessons for the successful and inclusive development of foundational digital systems.

Figure 4. **An ecosystem of interoperable microservices is part of a vibrant digital economy. Two, in particular, identity and payments, are essential.**

Messaging · Data repositories · Geographical information · Case management · Consent management · AI tools · Identity · Shared databases · Standardised collection · Marketplace platforms · Workflow automation · Security · Payments · Registration · Reporting dashboards · Scheduling · Terminology · Device management · eLearning · Business intelligence
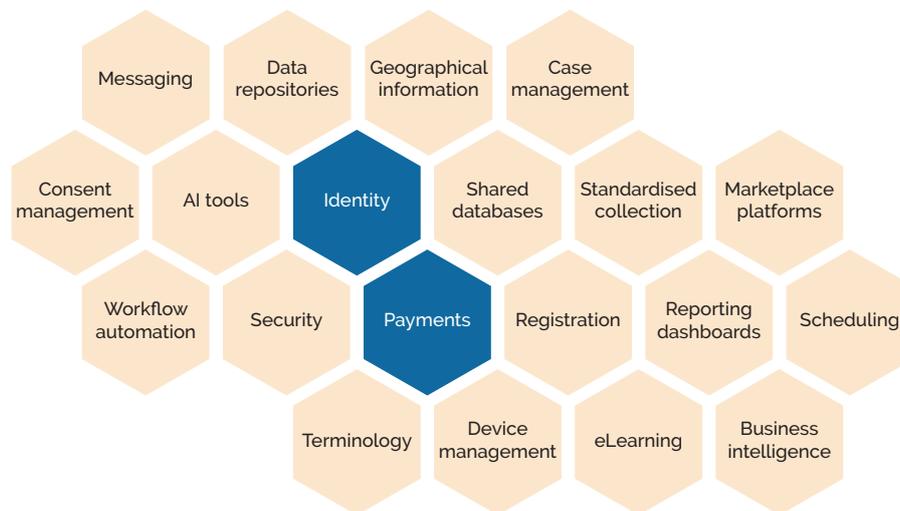
Note: these are adapted from ITU and Dial's list of potential priority microservices for investment.[86]

A safe and secure means of proving one's identity is fundamental to participating in many parts of a society or economy. Those without a unique, legal identity are often excluded from basic services and large parts of the formal economy, and yet millions of people – mostly people who are already marginalised or systematically excluded – are unable to prove their identities.[87] Globally, over one quarter of children under the age of five were not registered at birth; this figure rises to 58% in sub-Saharan Africa.[88] Without identity, and often without corresponding proof of address, people cannot access basic government services, cannot apply for bank accounts, and are often unable to participate in democratic elections.[89] A key metric of success for any identity system – digital or otherwise – is the extent to which it includes the most vulnerable. Identity does not strictly have to be digital, but digital registries can dramatically streamline the effectiveness, efficiency and management of identity systems. For developing countries, this presents an opportunity to 'leapfrog', from incomplete and easily compromised registries to cost-effective, complete digital systems. This is a strong investment, given the (relatively) small cost of a digital identity registry, compared to other national-scale infrastructure. However, there remains an ongoing debate around the governance of such digital ID systems – such as in India, where the Aadhaar biometric ID system was initially made compulsory, and established as the only route by which one could access some government services.[90]

Digital payments are an essential service in the digital economy, connecting people to financial systems and enabling exchange. Often working through simple SMS or USSD on a mobile phone, these tools can reach those left behind by traditional banking, such as residents of remote areas, or people with very little money.[91] Digital payment services give the unbanked the ability to make relatively low-cost transactions without cash, save securely, receive payments or remittances directly from others, and even access small loans. Moreover, the availability of digital payments as a microservice – meaning a service that can be built into other digital products and services – makes creating new digital services (such as e-commerce platforms or smart meters) dramatically easier. Mobile money enabled the One Acre Fund to tailor loans to farmers (reportedly helping them to increase recipient income by 50%), and it helped a public-private partnership operate water vending machines in Kenyan slums (reportedly reducing residents' water expenditures by 99%).[92] These initiatives were made possible, or at least they were made *cost-effective*, by the ready availability of a digital payments infrastructure.[93] Despite its importance and early success in East Africa, digital finance is still not a reality for many of the world's poorest. Worldwide, an estimated 1.7 billion people, including 77% of those earning under $2 per day, do not have access to a bank account or a mobile money provider.[94] Constraints on the growth of digital finance outside of East Africa include restrictive or unclear regulatory environments, low digital literacy, and the prevalence of extreme poverty.[95]

Alongside these foundational digital systems, it will also be important to invest in governance and ecosystem design. The security of personal data is a fundamental component of a successful digital system. Governments will need to guard vigilantly against the potential for data leakage, theft, and misuse (see Chapter 4.2).[96] For digital finance, they will also need to consider how to protect citizens from additional risks, such as irresponsible lending practices, which may fall outside traditional financial regulation. Beyond technical security issues, system designers must also consider social expectations, especially where innovations disrupt established practices. Failure to account for societies' expectations around issues such as privacy and data ethics has created problems for national governments in the past. The Aadhaar ID system in India, for example, over-reached in its requirements on citizens, and subsequent Supreme Court rulings have since reigned in the scope of the scheme.[97]

However, even once the governance and social framework is agreed, these foundational systems will still be of limited utility if they operate in silos. To maximise their value, they should contribute to an interoperable digital ecosystem – ideally, across borders, for example, within free trade areas. In part, this is about producing APIs so that the system can be used as a microservice (for example, a digital ID system could be used to provide a unique student identifier in an education system). Governments can have an influence beyond their own systems by mandating that other systems be interoperable, for example, by requiring that users be able to send mobile money to someone using a different carrier. However, there is a deficit in the level of technical expertise and guidance needed to implement standardised APIs.[98] Indeed, in the Commission's structured consultation with senior developing

country policymakers, the provision of technical standards and guidance was the foremost way in which they thought the international community could help.[99] Philanthropically funded projects such as MOSIP and mojaloop.io are starting to fill this gap, providing open source ID and finance systems that countries can adapt and implement. Their technical specifications may help governments to reach a point at which every person has access to identity and digital finance.[100]

Recommendation 10

The private sector and governments should create foundational digital systems that are interoperable and easy for others to build upon. **Donors, multilateral organisations and philanthropists** should provide tools, frameworks and funding to assist with this process.

Recommendation 11

Governments should implement basic digital identification architecture to allow citizens and businesses to safely and easily authenticate themselves. This will enable citizens to more efficiently access services in formal systems, and will help businesses to better legally establish themselves and attract investment.

Recommendation 12

Governments should mandate the development of an interoperable ecosystem of digital payment services, including allowing non-bank actors to operate payment systems with appropriate regulations.

5.3 Foster capital markets for digital innovation

Physical and digital infrastructure is not enough to foster growth; there also needs to be investment in businesses that will take advantage of the new technologies. This requires capital flowing to new start-ups and entrepreneurs, as well as to incumbent firms that want to upgrade their technologies or invest in new products. Local innovation is key: if a firm – such as Tigo Kilimo in Tanzania – wants to provide tailored agricultural insights to local farmers via mobile phone, it must develop a system that is relevant for local customers' needs.[101] The uptake of technology by businesses is one of the most crucial mechanisms to translate digital infrastructure investments into products and services that work in the local context. In theory, this should be easily achieved by efficient capital markets. Indeed, compared to other priorities such as digital infrastructure, financing for digital business is relatively inexpensive: some projects only require tens of thousands of dollars to get started. But many countries lack a dynamic investment environment to foster start-ups and entrepreneurs.

Despite hype around digital start-ups and high-valuation 'unicorns', the reality is that digital entrepreneurs in emerging markets face many significant barriers, not least access to capital. Equity financing – such as seed funding or venture capital – is an important route to growing digital businesses. However, evidence suggests that although equity financing has been growing in recent years, there is relatively little available in absolute terms.[102] Of the funding that is available, the vast majority of venture capital in Africa goes to projects with American or European founders.[103] Part of the problem is lack of scale and predictability in local markets. Venture capitalists who participated in the Commission's consultations said that their portfolio companies in Africa are an order of magnitude less profitable on exit than those in mature markets (there is scant official data on the returns to investment in developing countries). Large institutional investors cannot operate at this scale. They do not have the capacity or the risk tolerance for small and volatile deals. From the investors' perspective, there is a lack of 'bankable' projects; the net effect is a lack of capital for entrepreneurs. That said, some encouraging shifts are taking place on this front. Development finance institutions (DFIs) are investing in venture capital firms located in developing countries, which are better suited to distributing funds in these markets than foreign institutional investors.[104] Donors and foundations could also lead equity aggregator funds as first-loss investors (such as the platform created by Open Capital Advisors with the US Agency for International Development and others) or provide guarantor capital to de-risk debt funds.[105] Even once capital is flowing, investors must still grapple with a perceived lack of bankable projects, or, at least, much higher search costs in finding bankable projects.

Fostering capital markets requires more than just closing a funding gap: new ways to close information gaps and assess risk are also needed. Investments in digital industries and tech start-ups are prone to a lack of information, high costs of due diligence, and perceptions of high risk, all of which reduce the attractiveness of potential investments.[106] In more mature markets, there are well-established procedures and conventions to judge a potential deal: government databases, authenticated business registries, established market sizing techniques, and accredited financial statements. A lot of this is missing in emerging markets, where closing a deal can be orders of magnitude more expensive. This problem is compounded for small, local start-ups: it costs investors just as much to assess a local niche project as it does to assess one with global ambitions. Digital technologies can go some way to help close the information gap; for example, machine-learning tools can be used to assess the creditworthiness of borrowers. However, addressing this problem will require effort from government agencies and funders, too. For instance, philanthropists, donors and development banks could step in to fund organisations that intermediate deal appraisal, either by creating a service or organisation to provide standardised assessments and reporting, or by directly subsidising these activities for investors.[107] Developing country governments, meanwhile, could invest in the systems and registries that are used to demonstrate the bona fides of a potential business. Even establishing simple matters such as a verified business address can reduce the costs and friction of closing a deal.[108] The international community – including international donors and businesses – may also be able to assist developing countries to better understand returns on investment and manage capital costs. While such measures are unlikely

to overcome all barriers to capital flows, they can optimise the potential for investment within existing market constraints.

Encouraging flows of investment capital is crucial to the future development of digital ecosystems in developing countries. This should not be about tax breaks to lure large multinationals, but rather about essential investment in local technology upgrading, new businesses and infrastructure to foster innovative solutions to local problems. Carefully targeted investor and donor support, combined with governmental prioritisation of essential physical infrastructure and foundational systems (such as identification and digital finance), has the potential to unlock new paths to economic growth and inclusive development. Building an inviting environment for investors also requires a dynamic and competitive economy, one that is open for new players, and allows more productive firms to thrive.[109] Because the business models of many technology companies make digital markets prone to concentration, often favouring incumbents over more innovative entrants, establishing and enforcing effective competition law and policy will be an important part of the process (see Box 6 in Section 7.2 for discussion of taxation and competition policy in a digital age).

Recommendation 13

Philanthropists and donors should focus on supporting projects, including from **private-sector entrepreneurs**, that develop tools and services to reduce the friction and costs associated with investing in digital technology and start-ups in emerging markets (eg tools to perform due diligence on investment prospects).

Recommendation 14

Governments should take practical steps to improve the supply of bankable projects in local digital industries. Removing general barriers to doing business – for example, with better accounting standards or business registration – will help at the margins.

Recommendation 15

Private investors and philanthropists, in some cases supported by **development banks**, should lead aggregator funds (largely for private capital) and provide guarantees or insurance to de-risk venture investment. In this way, they can help close the funding gap for digital entrepreneurs and innovators in developing countries.

Salamina 'Katleho' Mofube making modifications to her Rasberry Pi circuit board, under a fluorescent light in Johannesburg, South Africa. Photograph: Dewald Brand, Pathways for Prosperity Commission, 2019.

Chapter 6
Reach everyone with digital technologies

If technology is to be a force for inclusive development, it must reach everyone. Only just over half of the world's population is connected to digital life; for the rest, the positive opportunities articulated in this report do not mean much. And in low-income countries, where development is most needed, only a small minority of people are connected to the internet.[110] Even in better-off countries where aggregate statistics paint a better picture, it is clear that the most marginalised people in society still miss out. Without a meaningful digital connection, people are not able to participate in digital work platforms, to benefit from new ed-tech tools, or to engage with their broader community and government online. The people who lack these opportunities are predominantly women, people with lower levels of education, and people in poverty.

Reaching everyone will require looking beyond existing business models and modes of operating. Business as usual has enabled progress to this point, but it will not be sufficient to go the rest of the way. Existing business models risk those unable to afford technological products and services – including internet connectivity – falling further behind, entrenching existing inequalities in a digital age. New business models for connectivity are therefore needed to connect people to the internet, and new design considerations will be necessary to make commercial products accessible to the poorest and most marginalised consumers. Any efforts to reach the marginalised will be stymied unless countries are also willing to tackle cultural norms around gender roles in society. In many parts of the world, such norms routinely limit women's participation and usage of digital technology.

6.1 Adopt new business models for connectivity

Expanding internet connectivity is a crucial aspect of building an inclusive digital society. Without broad digital access, the benefits will be confined to a privileged few, entrenching the digital divide along traditional lines of inequality.[111] The previous chapter discussed the need for basic physical infrastructure, but for most people, this is not the main problem. Although 2.93 billion people in developing countries (80% of the population) are already covered by a 3G cellular network, only 1.14 billion people in these countries (30% of the population) have ever used the internet.[112] The fact is that costs remain too high; many countries still fail to meet the global affordability standard of '1 for 2' (that is, 1GB of data

for no more than 2% of average monthly income).[113] The root causes of high prices range from monopolistic market structures to the realities inherent in building infrastructure across terrain which is difficult to access or sparsely populated. Business as usual will not achieve affordable access for everyone. New regulatory approaches and business models are required.

Making internet access affordable for the poor may require restructuring businesses to provide some services at below cost, essentially subsidising access for the poorest. This follows a similar logic to that of universal service funds (USFs), which levy a special additional tax on the telecommunications industry (and their users), ostensibly to fund programmes for people who cannot afford to be customers.[114] However, USFs are often ineffective at achieving their goals, opaque about where the money goes, and administered by technical agencies with little capacity for programmatic spending.[115] It may make more sense for governments and communications providers to pursue these goals through other means. A common fix around the world is geographic cross-subsidisation, whereby network operators make a loss on some rural customers, but set slightly higher prices across the board to offset these losses.[116] However, in developing countries, many of the poor already live in urban areas, and simply cannot afford the static prices set by these providers. Instead, providers could offer more flexible pricing based on a user's ability to pay (or based on a proxy measure, such as consumption). For example, the so-called 'freemium' model would give customers a basic daily data allowance (say, 20MB, plus five SMS messages), with the costs offset by those who consume more than the basic allowance.[117] Network operators could also invest in public access solutions: such as public Wi-Fi hotspots, edge-of-the-network caching, or zero-rating (free data) for certain digital services. All of these would be implicitly subsidised by paying customers.[118] These business models could be encouraged – or indeed, mandated – by governments.

Box 4: **Alternative business models for internet service provision**

Several alternative models are based primarily on internet service providers (ISPs) reducing costs for the consumer.[119] *Incremental pricing models* essentially provide different service options for those of varying incomes. These models are most common for mobile data plans, which allow consumers to choose from a set of prepaid subscription options.[120] These models rely on established backhaul, but can improve equity by providing options for low-income consumers. In *action-based payment models*, on the other hand, companies provide 'vouchers' for limited internet access, provided that consumers complete a particular task (such as responding to surveys or making particular purchases). However, such models are likely to remain inaccessible to the poorest. Alternatively, the private sector may subsidise access to specific online content through *zero-rating models*.[121] They may also use *'freemium' models*, whereby customers receive a baseline service (eg 10MB of data, or a small number of SMS messages) for free, with costs offset by charges on consumers exceeding this allowance.[122] Other models are designed to reduce costs for both ISPs and consumers. For example, ISPs may choose to form a partnership to share passive infrastructure, such as towers, with *passive site sharing*.[123]

Other models are dependent on developing community buy-in, especially in areas that have previously been unserved or underserved. **Local distribution models**, for example, entail targeted recruitment of influencers – community members who are intended to play a role in increasing uptake, thereby reducing the risk of entry for ISPs. Zero-rating services are also used to increase buy-in, by providing new users with an opportunity to assess the value of an internet connection. Finally, **community networks**, which are dependent on community training and commitments to be sustainable, may provide additional avenues for connectivity in areas unserved by traditional providers.

Governments may need to get involved to shape these markets. The private sector could technically offer affordable internet of its own volition. In India, for example, Jio has in the past offered free data packages to all users.[124] However, such business models are likely to be temporary loss-leading customer acquisition strategies or predatory pricing strategies to force competitors out of the market. These business models do not seem likely to sustainably offer affordable internet in a competitive market (indeed, it appears that Jio no longer offers free data).[125] This is a good place for government regulators to step in to shape the market – using regulations or incentives to encourage the sorts of 'freemium' or cross-subsidisation models discussed above. Such incentives may include tax breaks or preferential terms of operation for operators that participate, or regulatory penalties for those that do not.[126] Some countries already do this with other utilities, although through more heavy-handed directives. For instance, both the Tanzanian and Colombian governments mandate economic cross-subsidisation (lower rates for poorer customers) in electricity provision. A flexible approach may be more effective than blanket rules; these examples are not always successful and come with their own trade-offs, including reduced quality of infrastructure for subsidised customers.[127] Nonetheless, the government's intervention in shaping the market enables access for households that would not otherwise be able to afford it. Governments already take action to significantly shape another part of the telecommunications market by deciding which companies participate – and, as we shall see, such decisions bring opportunities for inclusion as well.

One of the most important aspects of mobile networks is the spectrum licences that govern who can broadcast radio signals.[128] Adjusting these rules can help promote broader access. In a competitive mobile network operator (MNO) sector, it is generally considered best practice to assign spectrum licenses through an auction-like process that grants an exclusive, national license to broadcast signals at a certain wavelength.[129] (Despite being best practice, such auctions have a mixed history with many failures, particularly in Africa. Some auctions have been so poorly run – aimed predominantly at extracting a high price for the government treasury, rather than at determining the fair economic price – that they failed to attract bidders.)[130] If managed well, these allocation processes provide an opportunity to build inclusive goals into the system. Spectrum regulators should set clear objectives for their auctions – such as improving affordability, coverage or competition – and use the auction itself as a key touch point at which their actions deliberately shape the

market. In practice, governments can lower spectrum fees in underserved areas to entice network operators into these regions, or impose minimum coverage obligations on bidders who win national licenses.[131]

With more nuanced rules around spectrum use, governments can create space for new initiatives that bring access to unconnected people. Traditional spectrum licences, which grant exclusive broadcasting rights, create barriers to potential coverage by smaller or newer initiatives that do not have the resources to compete in national auctions. Alternative approaches could enable delivery models that would not be viable competitors in larger-scale auctions. Community networks, for example, although criticised for a lack of scalability, can provide an alternative in places where it is not viable for a large telecommunications company to operate. These hyper-local networks are often run by community cooperatives that patch together hardware to provide a signal at low cost.[132] Looser spectrum regulations in Georgia, for example, enabled the establishment of the Tusheti community network for isolated communities in a remote, mountainous region.[133] Moreover, increased flexibility in regulations could allow smaller networks or networks with a pro-social mission to make use of already licenced frequencies as a form of 'fair use', if it does not interfere with the licence holder's business interests.[134] If this is not feasible, then regulators should, at a minimum, consider structures that allow a secondary market in spectrum sharing, trading, and repurposing. For example, countries can repurpose unused TV frequencies (known as TV whitespace or TVWS), which are perfect for backhaul connections because they can transmit information over large distances.[135] The Mozambique Communications Regulatory Authority, for example, recently approved regulations allowing for the dynamic allocation and management of TVWS, following several successful field trials.[136]

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Recommendation 16

Mobile network operators should embrace novel business models that enable the poorest to access services – such as cross-subsidised access, 'freemium' pricing, or public access solutions. **Governments** may need to develop incentives or regulations to encourage these pro-poor innovations.

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Recommendation 17

Governments should use spectrum broadcast licenses as a tool for inclusion. The allocation of rights is a key touchpoint where governments can shape the market, and the ongoing regulation of broadcast licenses could be loosened to allow small and innovative initiatives to spring up – for instance, through 'fair use' rules or secondary markets.

6.2 Design digital products and services for the most marginalised

Reaching everyone is not just a job for governments and charities, but for businesses as well. Commercial and retail services are rarely targeted to the poorest and the most marginalised people. Rather, such services are often designed for the market that can most quickly generate sustainable returns, which tends to be the middle-income market. Traditionally, this approach has been complemented with aid or corporate social responsibility programmes to bring products and services to the poorest.[137] However, this means that products are not designed for the poor, and services seldom cater to their needs. Mounting evidence suggests that where products are available, they are actually more expensive for people in poverty (for example, poor people may only be able to afford to purchase small quantities rather than in bulk, and they cannot take the risk of trying a new, higher-yielding crop).[138] Moreover, assistance and aid programmes do not usually operate at sufficient scale to truly reach all people. Just as network operators need new business models to ensure everyone has access, so too do other digitally enabled businesses or social enterprises need a deliberate strategy if digital products are to reach everyone. For many people, the main barrier is simply cost. For others, barriers stem from their digital capabilities and the tools they have at hand – for example, a person with a feature phone cannot use smartphone apps.[139] Other people still, may be excluded because the service is not available in their language.

Creating digital services and products that truly reach everyone will require completely rethinking the design of some products. Tinkering around the edges is unlikely to work, and may lead to only superficial inclusion that, under the surface, leaves many people excluded. A number of approaches seem to be emerging from a growing body of expertise in inclusive design.[140] First, entrepreneurs can create a simplified version of an established product, often at a much lower cost. The KaiOS operating system for mobile phones is doing this at a massive scale by creating a platform to run smartphone-like apps on much cheaper non-smartphones.[141] Advances in technology are also rendering previously expensive services more affordable. For example, machine-learning has dramatically reduced the cost of precision agriculture tools, and the ability to automate tailored SMS and local-language voice messages has led to more affordable agricultural advice.[142] A further approach is to sell at the right scale for the poorest households, which often cannot afford to buy products in their usual volume. For instance, Poa! Networks of Kenya offers access in blocks as small as one hour for $0.10, providing options for those who cannot afford standard data packages.[143] M-Kopa has developed a small, eight-watt solar panel system that it sells to families for an initial deposit, followed by daily payments of US $0.50 for one year. Estimates suggest this will save households, on average, around US $750 spent on fuel for lighting over the course of four years.[144]

Designing commercial services to be more inclusive will not automatically solve the problems of poverty, but it can help. Of course, the heavy lifting has to happen through social and economic change. Disadvantaged people

cannot buy their way out of poverty. It is tempting to take this to the extreme and assume that that commercial activities and entrepreneurship have little to offer people in extreme poverty; but this view is mistaken.[145] If better-designed products and services are less expensive, more varied, or of higher quality, then that is a good thing. There may be a role for foundations and NGOs to help socially oriented firms develop these products. Indeed, the UK Department for International Development was an early funder of mobile money development in Kenya.[146] Developing country governments can also try to push firms in this direction by providing incentives for those able to demonstrate social impact. For example, they may offer tax subsidies that reflect the extent to which an enterprise reaches excluded people, or creates local economic activity.[147] Current impact measurement approaches are not standardised, rendering them resource-intensive, subjective, and non-comparable between firms – and, hence, of limited use in a national-scale incentive programme. Philanthropists and governments could offer much-needed guidance and incentives to the private sector to improve and use these metrics in decision-making.

Recommendation 18

The private sector should seek opportunities to create useful digital products for the poorest. Striking the right balance between profitability, affordability and user experience may require designing specifically with inclusion in mind, developing 'lite' products, automating processes, or building products at different scales.

Recommendation 19

Philanthropists, donors and governments should support the design of digital products for the most marginalised people, by continuing to fund early-stage innovations, or by incentivising companies that demonstrate social impact.

6.3 Tackle gender norms that restrict technology use

Solving affordability issues might make connecting everyone to digital services financially viable, but it must also be *socially* viable. Full digital participation still remains hindered by social norms and discrimination on the basis of factors such as ethnicity, caste and gender. This must be considered when designing for inclusion. Social norms and beliefs will shape who uses technology and what they think they can do with it. The impact of gendered norms can be particularly pervasive, and this will be the focus of the rest of this section. Such norms are manifest in a perceived 'lack of demand' for technology by women in many parts of the world. Indeed, gendered norms have been linked to lower female usage of mobile phones, computers, digital finance and just about every other digital service.[148] These norms can be rooted

in ideas around a woman's safety, purity, or her social obligations to perform domestic labour instead of using new technologies.[149] Often, norms are resistant to change, even if they have clear negative impacts on economic development and human capital.[150] This is a difficult issue – shaped by national and regional cultural attitudes and practices that no single actor, not even governments, can control. However, it is still possible to begin to tackle it. Services can and should be better designed to meet the needs of marginalised women, and today's social policies can and should be designed in the knowledge that they will shape tomorrow's socio-cultural environment.

Creating venues specifically for women can increase their digital participation. Social norms can restrict participation even where resources are available. For example, in remote areas of India, many women remain unable to use Wi-Fi hotspots, despite ambitious national initiatives, because of the public nature of the venues. In many rural communities, these are seen as inappropriate or unsafe for women.[151] Digital access solutions should therefore be tailored to enable access despite these norms. In South Africa, following a consultation process with rural women, community computer kiosks were installed in a village centre, increasing women's computer usage, digital skills, and even financial inclusion.[152] Crucially, the programme took the existing social environment into account. The kiosks were set up in an area that was easy and appropriate for women to access, and the project received the blessing of the village chief before installation and use. In this case, the service was designed for use by both men and women, but similar venues can also be more specifically targeted towards female participation. For example, in Pakistan, a country with one of the world's highest gender gaps in terms of digital access, the Shaheen I-Tech Lab operates in a girls-only school, offering digital skills courses from HTML coding to typing.

It is important that countries act to shape socio-cultural environments that favour digital participation. Social norms are slow to change, and there is a risk that targeted programmes like tech labs succeed only in small pockets, and, thereby, may actually reinforce exclusion and segregation. Inclusive development requires changing these norms, not just working around them. While governmental policies that tackle explicit discrimination are a prerequisite, they can be complemented by advancements in education and communication strategies to support a more inclusive society. The Commission's analysis of several developing countries across Asia and Africa found that education is the largest predictor of phone ownership and use.[153] Beyond digital inclusion, education also changes power relationships, giving women more confidence, and greater capacity for both economic participation and agency for decision-making in their lives. In addition to education, governments can pursue a range of policies that are proven to help empower women – such as giving daughters equal inheritance rights, and providing financial incentives for girls to delay marriage until adulthood.[154] Interventions can also directly approach men's beliefs with a view to tackling these norms. Social norms change most rapidly when people believe their peers endorse the new norm: one study in Saudi Arabia, for instance, showed that many

younger men privately supported women working outside the home, but they believed their neighbours did not; once this belief was corrected, their wives were more likely to seek and obtain work.[155]

Digital technologies can help break down cultural barriers that limit female participation. In Pakistan, biometric technology was introduced to ensure that women received government payments directly, and, hence, that they could increase their financial independence; previously, 47% of all transactions were initiated by male representatives of the recipient (some of whom were even below the legal age to act in this capacity).[156] Technology can also help to expose women to new, positive role models, raising their aspirations and demonstrating alternatives to the limited roles expected by their society.[157] There have also been successes in changing cultural discourses and beliefs through broad digital media, such as through popular television in Brazil and a women-only Facebook group in Pakistan.[158] Following such examples, information campaigns and social marketing may be used to highlight and portray women's social and economic participation, showing people alternatives to the status quo. Supporting these sorts of information and communication initiatives is a low-cost way for governments and donors to promote gender equality at scale.

Recommendation 20

The private sector and civil society should create specific opportunities for women to engage with technology (through, for example, women-only internet cafes or skills labs), incorporating an understanding of the social norms that might affect usage.

Recommendation 21

Philanthropists, civil society, the private sector and governments must actively challenge existing gender norms that restrict women's use of digital technology. Ways forward include promoting 'connected' female role models, and showing leaders and peers rejecting old norms.

Ahumuza Bruno, 8, is checked for pneumonia using a butterfly ultrasound scanner – a probe connected to a mobile phone – in Kabale, Uganda. Photograph: ©Esther Ruth Mbabazi/ New York Times, 2019

Chapter 7
Govern technology for the future

The opportunities described in this report are varied: some are completely new, while others merely extend current frontiers. Either way, it is incumbent on society to steer this technological change for good. Societies, through their governments, set the frameworks and boundaries within which new business models and digital designs can proliferate. This is no small task for government leaders. The unprecedented pace of technological change and the emergence of new risks in the digital era (such as algorithmic bias, cybersecurity, and threats to privacy) are creating headaches for even the most well-resourced countries. These issues are high priorities for developing countries as well.[159] The business models and tools offered by digital technologies fundamentally shape what people do and how they do it. Freelancers might face a job market in which their prospects of getting hired are partly determined by an algorithm.[160] Banks might face a financial system with heightened risk from new, non-bank deposit holders.[161] These issues, and many others, will require government attention.

Many governments are constrained by limited capacity and resources. Digital technologies cannot fully solve these issues, but they do provide real opportunities to improve governmental administration and enhance the quality of public services. There is an opportunity to deliberately shape the digital future, and government leaders and public practitioners should not simply step back and let this wave of change wash over them. They should pick up the tools available to them and become authors of the technological revolution. This will require new and adaptive approaches to decision-making in a time of uncertainty. Finally, with rich nations and large global bureaucracies unlikely to deliver inclusive integration, developing countries may find that their best chance for success lies in coordination and cooperation among themselves.

7.1 Use digital technology to improve government administration and service delivery

Many of the opportunities explored in this report require high-quality and effective work from governments; government capability itself is far too often the bottleneck. Governments have the central role in the implementation of a national digital compact, but they are often hampered by low administrative capability, limited funds, corruption and leakage.[162] At current rates of improvement, some countries will simply never reach the level of state capability of more-developed nations.[163] Digital technologies can help close this gap by

catalysing improvements in government efficiency and efficacy.[164] In Nigeria, for example, urban services presented on a digital map are helping policymakers to reach crucial public policy decisions.[165] In Pakistan, the digitisation of land registries reduced the processing time of property transactions from two months to 50 minutes.[166] In Costa Rica, digitalisation of filing systems helped businesses to prepare their taxes in less than half of the previous time required.[167]

Digitisation can go beyond improving efficiency, to redefine the ways governments and service providers deliver services. Low-cost data collection and powerful analytical tools can help systems learn and improve by creating feedback loops for decision-makers. For instance, the malaria surveillance tool MoSQuIT, which combines real-time incidence and treatment data, has allowed the health system in India to adaptively allocate resources in real time.[168] Digital technology can also make it easier to perform key tasks, such as proactively responding to citizens in need. In Mali, technology played an important role in enabling Muso, a health NGO, to significantly decrease child mortality by deploying a community case-management approach. Muso uses digital technology – mobile devices and a data dashboard – to help community health workers better manage their cases, resulting in a 10% increase in the number of houses visited each month.[169] In Rwanda, hospitals' waiting times for blood supplies were reduced from four hours to 45 minutes, thanks to a system that combines instant online ordering with drone-based delivery.[170] Service providers can also use digital tools to build systems that tailor services to the specific needs of users. For example, adaptive learning programmes, such as Geekie in Brazil, are used by millions of students, and have been shown to significantly impact student learning.[171] Similarly, in revamping a fuel subsidy programme in India, the government was able to use the foundational digital systems – digital ID and mobile finance (discussed in Section 5.2) – to better reach the people most in need of the subsidy.[172]

Box 5. Digital systems for better service delivery

Digital systems can bring immense improvements to the administration and management of large programmes. Data is the fuel that powers such systems, and the success of digitisation depends on the quality and consistency of the data. In many countries, particularly developing countries, datasets are often non-existent, incomplete, or unavailable in a machine-readable format.[173] Before policymakers go into modernisation projects with overly high expectations, they should first put in place the right technical frameworks to standardise data and make sure it gets to the right place.[174]

An astronomical amount of information is routinely generated and stored across developing countries, but most of this happens in isolated systems (such as an offline hospital record, or the corporate server of an ed-tech application).[175] Information on particular issues is often of low quality, collected unevenly, and may not even be designed to capture policy-relevant metrics.[176] Even if records from every hospital were pooled into a single place, it would be almost impossible to derive useful insights from inconsistent

and unstructured data. Standardising data collection is necessary to both ensure quality and ensure that datasets can 'speak' to each other to reveal useful insights.

Having consistent and quality data is the first step. From there, information needs to be channelled to an appropriate level at which it can be utilised. Governments and system managers can design digital interconnections to collect and aggregate information from disparate sources, and provide system-level connectivity. For example, successful tools can give national education policymakers access to insights derived from their schools and districts. This can inform decision-making, create feedback loops, and strengthen bottom-up accountability. These interconnections can be built between existing systems, but as new digital systems are built, there is also the potential to automate the collection and aggregation of data, relieving the burden on frontline workers. For instance, mTrac in Uganda, and SMS for Life in Tanzania and Kenya have embedded simple SMS reporting of disease incidence into their workflows, improving the information available to national decision-makers.[177]

Inclusion is a key aspect of a government's obligations to society in the digital age. A trend towards 'digital by default' for new services runs the risk of excluding non-connected people from crucial government services (and so it is important to maintain analogue delivery channels).[178] Governments in the digital age have a special obligation to ensure their services are designed to address inclusion and the needs of the most marginalised users. For example, by focusing on more accessible technologies, rather than the internet, SMS and low-bandwidth approaches have been used to give free, tailored information to pregnant women and mothers in Mexico, to provide educational resources to students in Tanzania, Kenya, Ghana, and Cote d'Ivoire, and to provide free public bus schedules to citizens in Chile.[179] Delivering inclusive public services also requires consideration of the capabilities and attitudes of practitioners. Co-design with the users of technology is crucial for impact. In Kenya, the quality of clinical data has improved, thanks to systems that make recording data easier. For example, a paediatric database records pre-specified, standardised information, to ensure data can be easily compared. Paper-based checklists (that can be scanned by a smartphone into a standardised database) combat doctors' resistance to new digital workflows.[180] (See Box 5 for more on the benefits of standardised data.) Finally, the inclusiveness of public services can also be improved by setting performance metrics that specifically reflect inclusion. For instance, officials can be made accountable for increasing not just the number of active users of a particular service, but also the number of active users from marginalised or low-income groups.

By starting their digital transformation strategies in key areas for economic development, low-income countries can get the most out of their investments. Digital transformation will be particularly challenging for low-resource and fragile states. Government digital modernisation projects often fail to meet deadlines or to remain within allocated budgets.[181] The potential gains from digitisation are significant, but they cannot be achieved overnight, and competing initiatives are a real challenge. It is essential to clearly prioritise investment. Apart from the digital essentials described in

Chapter 5, countries' initial priorities should include taking steps that help stabilise the economy – measures such as digitalising tax collection or land registries, for example.[182] Moreover, identifying the highest-volume processes in government is a good way to find initial candidates for digitalisation; streamlining these processes will likely save resources currently used to access information trapped in filing cabinets and district offices.

Recommendation 22

Governments should actively look for opportunities to use digital tools to improve the effectiveness, efficiency and reach of public administration and service delivery. This might include providing educational resources tailored to students' needs, distributing tax refunds via mobile money, or using national-level insights to manage pharmaceutical supplies.

7.2 Make regulations that are suitable for technological uncertainty

Over the centuries, new technologies have consistently challenged traditional regulatory frameworks; the current wave of digital technologies is no exception. Predicting what benefits and risks new technologies will entail in the future is very difficult. In times of change, policymakers must navigate carefully. On the one hand, they want to avoid stifling innovation; on the other hand, they do not want new (and potentially dangerous) practices to go unregulated.[183] An example from history underscores this point. When the first road locomotives (precursors to the internal combustion engine) were introduced in Britain in the late 1800s, strict laws were enforced to address the risks. While regulation of new industry is important – not least an industry with such risks as those involved with automobiles – these initial rules were so blunt and obtuse that they hampered innovation, and slowed down the British car industry for decades, relative to other countries.[184] Balance will be needed in the digital age just as in previous ages.

In many cases, the regulatory challenges brought by new technologies require the development of novel rules and legal concepts. Government officials should not assume that laws and regulations tailored for an analogue past will remain fit for purpose in the digital era. Maintaining the status quo can be detrimental if the rules are obsolete or fail to guard against major new risks. Even when a new company is operating in a sector that is already regulated, some characteristics of their business model might require changes and adaptations of the existing rules. For example, definitions of 'data' and 'communication' may need to be updated to account for the modern hyper-connected internet age, or an accelerated bankruptcy regime for mobile money may be necessary in an era of mobile money.[185] Such amendments can often become caught up in political debates about the fundamental purpose of

regulation, and whether innovative businesses should be treated in the same way as, or differently from, existing firms. Box 6 outlines three major areas in which law and regulation are particularly stretched by digitalisation, and offers suggestions about changes that might be considered.

Box 6. **Law and regulation in a digital age**

The central role played by data in digital technologies poses new challenges for policymakers and regulators trying to respond to change. Three key areas in which laws and regulations might need to be reviewed and updated are:

Data governance: The lack of regulatory frameworks governing data can expose people and businesses to risks (such as cyberattacks and data leakages), undermine confidence, and lead to inefficiencies. Governments should establish guidelines around the collection, use and storage of data.[186] Such guidelines are relevant for all types of information (e.g. business information, government data, satellite imagery), but they are even more important in the case of personal data, which should be accompanied by some level of informed consent. Such guidelines should also encourage tools, standards and regulations to enable data sharing and interoperability.

Taxation: The digital economy is transforming the nature of businesses. Determining tax valuations for digital services and the data which enables and underpins them is difficult. Pinpointing where or how value is created is also complex given the intensive use of intangible assets, and the different revenue models adopted by technology companies. Moreover, digitalisation adds complexity to the already challenging task of taxing multinational companies in the globalised economy. Both developing and developed countries have been struggling to raise taxes from multinational companies that offer goods and services worldwide, and because digital services do not require a physical presence, per se, the digital economy creates greater incentives and opportunities for base erosion and profit-shifting.[187]

Competition policy: New technologies can undermine effective competition. For example, new technologies can usher in new opportunities for anti-competitive behaviour, and can enable business models with stronger tendencies towards monopolies. Traditional competition policy has yet to adapt to deal with features of digital platforms. For example, effective competition policies in the digital age must evaluate such matters as identifying the sectors and geographies in which a company operates, understanding the role of data in creating a product, and dealing with competitive dynamics that are not manifested in prices.[188] This requires countries to establish or update competition policy regimes to ensure a dynamic and diversified economy, lower prices, and better products and services for consumers.

Traditional regulatory processes are not dynamic or responsive enough to govern complex and fast-moving technological changes. Lawmakers and regulators should therefore equip themselves with better instruments that

allow them to iterate and experiment. One way of doing so is through adaptive processes, which recognise that there is no uniform, standard way of dealing with a problem, and focus on 'learning' as a core value, instead of stability.[189] An adaptive approach is especially suited to problems that are unclear or prone to change. Rather than trying to develop the perfect rule (which may be outdated before it is even implemented), decision-makers could create interim guidelines, paired with rapid feedback loops and a commitment to iterative fine-tuning.[190] However, successfully applying adaptive regulation requires a culture shift: senior leaders must become comfortable with the occasional mistake.[191] Another approach is to explicitly limit the scope of a rule – either with a 'sunset clause' that gives the rule an expiration date, or by only applying the rule to a specific geography or sub-market as an experiment.[192] 'Regulatory sandboxes', which allow firms to test new products on a small pilot scale before being subject to the full regulatory regime, are examples of this approach. Similar mechanisms have been used in the energy sector in Singapore, drone regulation in Malawi, and fintech products in the United Kingdom.[193]

When the impacts and effects of a new technology are uncertain, deciding what to regulate can be difficult. One way to mitigate this problem is to regulate on the basis of desired outcomes, rather than by trying to decide which specific activities to allow or disallow.[194] A complementary strategy is a risk-weighted approach, in which regulations apply to firms to different extents based on their market share, their importance, and the potential risks they present.[195] This tiered approach can lighten the burden on new market entrants (which have fewer resources for compliance), and thus resolve a common problem, whereby new regulations act to protect large incumbents.[196] Such an approach is taken, for example, in the Basel III financial regulation framework, in which different regulatory requirements depend on the size of the bank.[197]

The wealth of data generated in the digital age can inform better governance as well as regulation. A data-driven approach to governance can address one of governments' biggest challenges: incomplete information. Section 7.1 described how large datasets and analytical tools can improve the administration of government programmes. These tools can also help regulators gain a better insight into the risks that they are trying to manage.[198] Technical regulatory agencies are often adept at handling large amounts of complex information, but they cannot do this if they do not have the necessary data and information in the first place, or if the data is not readily interpretable. It is therefore crucial that regulatory agencies build systems that support data gathering and reporting (as discussed in Box 5). For example, the National Bank of Rwanda developed an electronic data warehouse to automate reporting from the banks that it supervises, increasing the quality and reliability of the data it uses to make regulatory decisions.[199] However, this is not an argument for government agencies to assume the role of some kind of digital leviathan that indiscriminately absorbs any data it can find: national-scale collection and use must be accompanied by trustworthy and robust data protection frameworks (as outlined in Section 4.2).

Of all the areas on which the Commission's work has touched, the governance of digital technology is the issue with the greatest knowledge gaps and the most urgent need to fill those gaps. Existing approaches are not working and, as discussed in Section 7.3, many developing countries are currently adopting regulatory models that are, at best, suboptimal – imported directly from the United States, European Union or China, without analysis or assessment as to whether they are suitable for or relevant to specific national contexts. There is a clear need for the rapid development and piloting of context-specific solutions to these new challenges. These efforts should be led by and in partnership with developing countries themselves, but these countries should also receive support from the international system.

Recommendation 23

Governments need new adaptive and flexible approaches (such as risk-weighted rules or regulatory sandboxes) to tackle the regulatory challenges emerging from digitalisation. They should not assume that old regulation is still fit for purpose in the digital age.

Recommendation 24

Governments should leverage data to inform regulatory decision-making, working with the **private sector** to build systems that improve officials' understanding of the industries they regulate.

Recommendation 25

Governments and philanthropists should support bold, new efforts to develop first-best regulatory solutions designed to meet the unique needs and priorities of developing countries.

7.3 Coordinate between countries for digital integration

International governance of technology is important, not least because the inclusiveness of future growth depends on global interconnectedness. As described earlier in this report, the current wave of technological change offers the opportunity to bring benefits to as many people as possible. While this requires significant work domestically – forging a national compact to build new industries, ensuring that change is people-focussed, building the digital essentials, making sure services reach everyone, and improving national governments – there is undoubtedly a global component as well. The most rapid and successful economic development comes from integration into global markets. Many technology companies operate across borders,

delivering services across many jurisdictions, often without a physical presence. This raises issues of jurisdiction for matters such as competition policy and tackling cybercrime. But it also raises complex problems around taxation and the distribution of value from digital transactions (see Box 6 for more on these issues).[200] Even firms that appear entirely contained within a single country might purchase cloud computing services from a foreign firm, and process their data on foreign servers. In such a global market, developing countries must ensure that participation brings jobs and inclusive development.

Current global discussions about governing, managing and regulating digital technologies are dominated by richer nations and might not support developing countries' needs. A recent United Nations panel on digital cooperation argued for the need to strengthen multilateralism, multi-stakeholderism, and diversification of voices in digital cooperation.[201] This is an important goal for the global community, but it will take time to achieve. In the meantime, a multipolar regulatory architecture is emerging, with norms being shaped by powerful actors such as the United States, the European Union and China.[202] Because of the dominance of these actors on the global stage, their emerging norms are becoming de facto global standards, which may not be a good fit for developing countries. To add to this, traditional international organisations – particularly the technical bodies that govern the internet – remain dominated by larger, richer nations. Developing countries are often underrepresented and unable to make their voices heard, due to structural issues such as vote shares and informal norms.[203]

Facing this global multilateral environment, countries may decide that it is better to operate unilaterally. However, for most countries, international cooperation might offer better solutions. Most developing countries constitute only relatively small markets, contributing negligible revenue to large, multinational firms.[204] In the best case, these states may be able to regulate their homegrown, domestic digital firms, but should their rules deviate too far from the de facto global standards and require too much compliance effort, global firms would be likely to significantly reduce their offerings or withdraw from the country completely. Consequently, smaller nations can neither act unilaterally to forge their own rules, nor expect global multilateral institutions to protect their interests. International coordination between smaller groups of countries offers a possible solution: by pooling their resources and political clout, developing countries will have the opportunity to define governance regimes that meet their own needs.[205]

A coordinated approach through regional or other like-minded groupings presents developing countries with an opportunity to develop a governance model that works for them. Currently there is a patchwork of approaches governing all aspects of technology.[206] While each country's regulatory priorities will reflect its specific context and goals, developing a coordinated set of international standards between a coalition of countries would be beneficial – both for resource-constrained regulators, and for the regulated firms. In practice,

developing countries could start by coordinating with regional neighbours, or even – because digital trade transcends geography – by working with any like-minded countries with shared policy priorities. A coordinated approach would also foster innovation, and enable deeper integration between countries on the basis of regulatory compatibility, a practice known as regulatory 'passporting'.[207] Establishing shared governance frameworks and tools for interoperability between systems will be important in unlocking this potential, as discussed in previous chapters. The more integrated these systems and markets are, the faster, cheaper and more reliable it will be for entrepreneurs to create new products, and for customers to access affordable services across borders.

Truly achieving inclusive, technology-enabled growth will require action from all countries, rich and poor alike. As multilateral and global organisations develop proposals to govern the digital future, they must include developing countries in the process and consider their interests from the very beginning. But developing countries should not hold back and wait for a global multilateral approach to emerge – they can take charge now. Countries can look for models of cross-border regulation that work for them, coordinating with both developed and developing countries where goals align. The incentives for coordination over digital policy will be stronger in areas where cross-border spillovers are more immediate, or where the efficiency gains from acting together are greater. Cybersecurity and data protection offer two possible examples. Cross-border governance of technology is unlikely to be an all-encompassing framework from day one, and some more complex issues such as multinational taxation will take time to tackle. However, there are certain specific issues of technology governance for which cooperation among countries can already begin. Given the scope and scale of this matter and its associated risks, there is no reason for countries to delay cooperation.

Recommendation 26

Developing country **governments** should coordinate on technology governance at the regional and international levels where their values and interests align, and **multilateral organisations** must be responsive to the needs of developing countries when creating global standards.
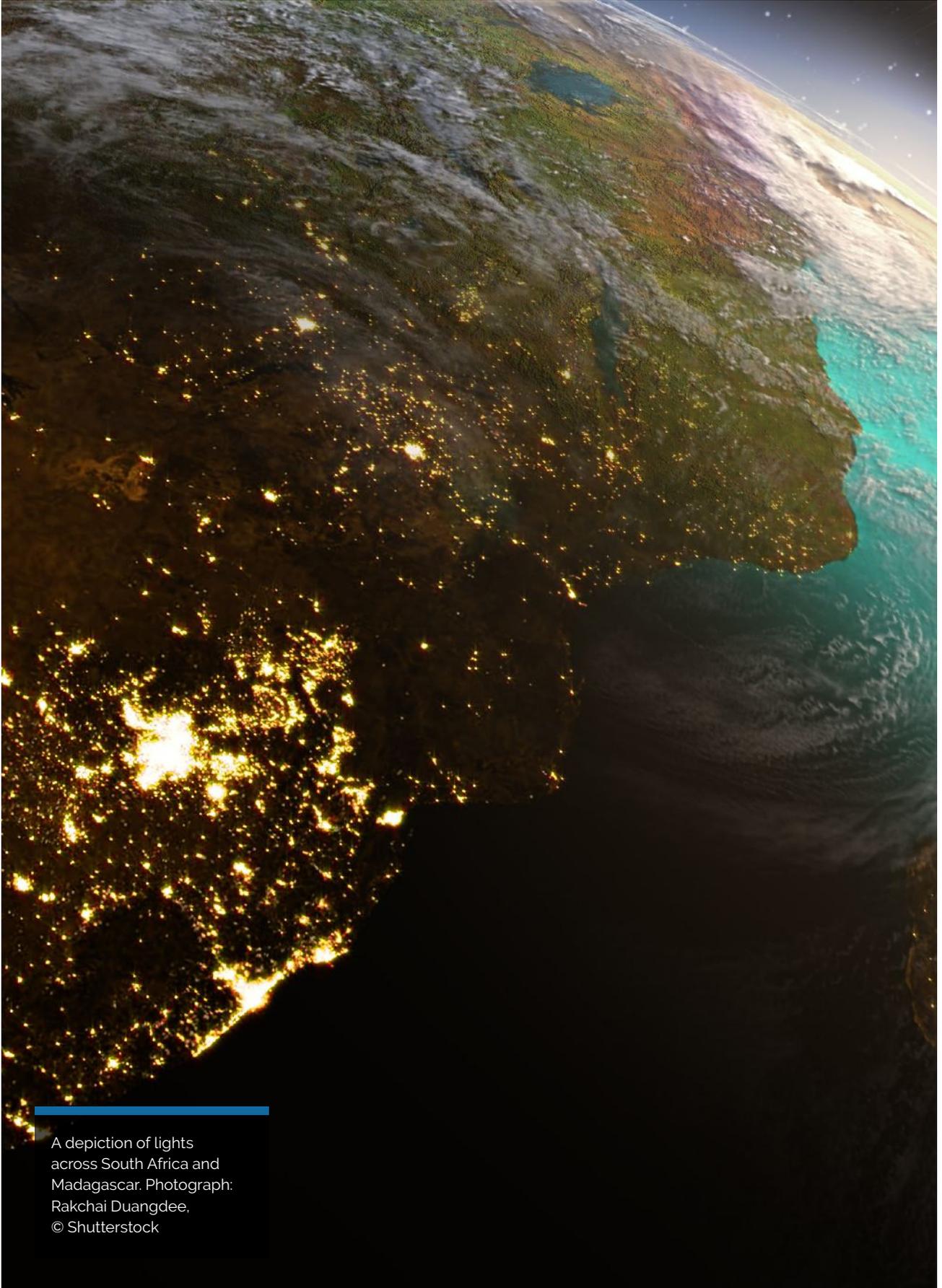
A depiction of lights across South Africa and Madagascar. Photograph: Rakchai Duangdee, © Shutterstock

Chapter 8
Conclusion

The ground is shifting beneath the status quo. Navigating major technological change requires leadership, vision and collaboration – not tinkering in silos and piecemeal projects. There is no universal blueprint for digitally led development. Nonetheless, some components will be important for every country. These are broadly encapsulated in the idea of a national digital compact: the notion that complex forces of technological change can be harnessed for inclusive growth if government, the private sector and civil society work together. The digital compact is about engaging in the methodical, deliberate work of creating the right environment for technology to fuel inclusive development.

A digital compact is a means to an end: coordinated action to put people at the centre of the digital future, build essential foundational components, reach everyone, and govern technology well. In some countries, it may not be possible to forge a compact as envisioned in this report. Nevertheless, even without an overarching plan, the other 25 recommendations discussed in this document are still worth pursuing. The digital essentials in Chapter 5 constitute a good first step. These basic ingredients could be initial priorities for resource-constrained countries. And before more whole-heartedly embracing disruptive change, governments should ensure that they have an element of trust and a social license from citizens and firms. The Commission's Digital Economy Kit (described in Box 2) provides a guide to help with national development planning, and this resource may help to translate a digital compact or shared political vision into the nuts and bolts of economic policy and strategy.

Civil society, the private sector, multilateral organisations, donors and philanthropists all have important roles to play in building an inclusive digital future. To be sure, national governments must take the lead, but it is up to civil society and individual citizens to engage and shape the priorities of government. The private sector, for its part, must be willing to let innovation thrive. One of the biggest risks to digital-led development is incumbents seeking protection from competition rather than deploying new technologies themselves. Firms can also contribute to the digital future by designing business models that reach everyone, and by investing in the skills and the people that will power digital industries. International organisations can help with setting governance rules that include developing countries, and assist them in their digital transformation. Donors, multilateral organisations and philanthropists should also play a part. Many of the proposals in this report will likely require funding or concessional finance.

This is the final report of the Commission. In the two years of the Commission's journey, the largest knowledge gap we have identified is that of technology governance. While the Commission has started to examine the issue both in this report and elsewhere, we have only scratched the surface. **Therefore, a new technology governance hub will be established as a legacy effort of the Pathways for Prosperity Commission.** This hub will ensure that the work of the Commission will continue to be translated into action, developing new thinking about technology governance and helping countries create inclusive digital economies.

The future is uncertain, but the Pathways for Prosperity Commission is optimistic about the potential of new technologies. If countries prepare for change and manage it well, digital technology can be a strong force for inclusive development. Technology can power new industries and livelihoods; improve the quality of health and education; and connect people in new and exciting ways. In all of these cases, success or failure is almost never determined by the technology alone, but rather by how it is managed and where it is used. **It is within humanity's power to create a better world for everyone. Technology is one part of that quest. This report aims to help everyone to push in the right direction.**

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Endnotes

1   For more on Amazon and Google's cloud-based computer vision services, see Amazon (2019) and Google (2019).

2   Refer to previous Pathways for Prosperity Commission reports: *Charting Pathways for Inclusive Growth, Digital Lives, Positive Disruption*, and *Digital Diplomacy* (Pathways for Prosperity Commission; 2018a, 2018b, 2019a, and 2019c).

3   Baldwin (2016).

4   It is important to note that, despite the gains for countries that participated, little of this benefit reached the poorest people in the world. The global consumption floor – the standard of living for the poorest people in the world – barely increased from 1981 to 2011, with the poorest still living on around $0.60 per day (in 2005 US dollars). For more information, see Ravallion (2016).

5   For more on how this impacts individual lives, read Pathways for Prosperity Commission (2018b).

6   See Pathways for Prosperity Commission (2018a) and Lippolis (2019).

7   Indeed, while modern-day technologies are available in almost every country, the fact is that there are major differences in the *intensity* of usage, and this gap is widening (Comin and Mastieri, 2018). For many developing countries, there is a shortage of profitable opportunities to use productivity-enhancing technology, and the broader environment – encompassing business regulations, infrastructure, financial availability and more – may even preclude high-intensity usage of new technologies (Pathways for Prosperity Commission, 2018a).

8   For example, in Indonesia and Bangladesh, growth in services employment (which increased by more than 30 percentage points in terms of employment share) far outpaced growth in manufacturing employment (which grew by less than 10 percentage points) over the 1991–2017 period (Pathways for Prosperity Commission, 2018a).

9   Rodrik (2018) argues that new technologies may not make it any easier (and may actually make it more difficult) for developing countries to pursue export-oriented manufacturing strategies.

10   According to International Labour Organization (2018), Africa's labour force is projected to increase by 285 million between 2010 and 2030. For more on the future outlook for structural transformation in Africa, see Fox, Thomas and Haines (2017).

11   See Loungani et al. (2017). The figure presented here refers to the direct contribution of services in exports only, and, thus, is likely to be an underestimate of global trade of services. Services account for at least a third of manufacturing exports, making the overall share of services in global trade substantially higher. Francois, Manchin and Tomberger (2013) suggest that services may account for up to half of global trade.

12   For an in-depth exploration of the technology-enabled pathways described by the Commission, read Pathways for Prosperity Commission (2018a).

13   See Khan (2013) for analysis of how the different 'political settlements' can explain how similar technology policies can have varied performance from country to country. Khemani (2017) and World Bank (2008) provide more analysis on the political economy of reform. See Frey (2019) for a discussion of the historical importance of citizen buy-in in the face of technology-based disruptions.

14   Pathways for Prosperity Commission (2019b).

15   Hanna (2016).

16   Hanna (2007a) and Hanna (2007b) discuss in more detail these issues of government coordination.

17   Mexico started a National Digital Strategy in 2014 that charged traditional ministries to exercise resources in specific projects that are part of the digital agenda. This way, ministries take an active role on the transformative digital agenda in Mexico. (OECD, 2014b). In Peru, as part of the 2011 'Digital Agenda 2.0' the government created a high-level committee by supreme decree, requiring coordination between senior leaders of all departments. (OECD, 2019a).

18   See International Labour Office (2018) for a report on unemployment and underemployment. The figure includes informal workers in agriculture. This problem is even more severe among young people. For example, 40.3% of South African people aged 15–34 are reported as not being in formal employment, informal employment, education or training (Statistics South Africa, 2019).

19   See Banga and te Velde (2018a) and Banga and te Velde (2018b).

20   Dworkin (2019).

21   Banga and te Velde (forthcoming).

22   In our research, we met an Indonesian woman who used the internet to check whether a pig seller was justified in demanding a higher price. See Pathways for Prosperity Commission (2018a) for more information on the prospects of connecting informal workers to larger markets, and Syngenta Foundation (2019) for details about promising new agri-tech platforms.

23   The seven countries are: Bangladesh, India, Kenya, Nigeria, Pakistan, Tanzania and Uganda. See Pathways for Prosperity Commission (2018b) for more information on phone usage.

24   During the Commission's 'South Africa in the Digital Age' workshops using the Digital Economy Kit, one of the nation's largest corporations indicated that the vast majority of their staff training occurs outside the government-accredited system. Ngure (2013) provides a study on Kenyan TVET, while Yamada, Otchia and Tanigochi (2018) examine skill needs in Ethiopia's garment sector. See also Wolter and Ryan (2011) for a broader review of apprenticeships.

25   See, for example, Banga and te Velde, (forthcoming), Tripney and Hombrados (2013), Olfindo (2018), and Kumar, Mandava and Gopanapalli (2019).

26   CloudFactory employs people to perform microtasks such as labelling training datasets used to train self-driving cars in Silicon Valley and providing transcription services for researchers in European universities. See Olsen (2018) for a review of CloudFactory and similar organisations. See also Banga and te Velde (2018a) for a description of in-house training in digital skills offered by manufacturing companies in Kenya.

27   See iMerit (2019) and Anudip (2019).

28   Surveys from 16 developing countries show that less than half of workplaces offer any skills training to employees, with rates of less than 10% in countries such as Indonesia and Myanmar. See Banga and te Velde, (forthcoming) and World Bank (2019a) for details. In contrast, two thirds of businesses in the UK offer at least some training or development time (MPA Group, 2019).

29   A local government in central China, along with the Taobao e-commerce platform, set up an incubator for small online businesses, providing workshops on key digital skills and market knowledge (Yan, forthcoming). In India, a TVET programme run by the Ministry for Textiles provides training, including to marginalised communities. Trainees learn basic textile skills and necessary digital skills for the industry. Participation in the programme, leads to employment with partner companies. (Ministry of Textiles, Government of India, 2019).

30   See Dworkin (2019) for a discussion of how, even in rich OECD countries, the focus on 'flashy new careers' may obscure more important trends in the labour market.

31   Because soft skills are complementary to machines, they are unlikely to be automated. For a recent analysis of the increasing importance of social skills for the economy, social progress and GDP growth, see Deming (2017), UNESCO (2015), and OECD (2015). For more details on methods to develop soft skills, see Claxton, Costa and Kallick (2016), and The Economist (2018).

32   The organisations that participated in the 'South Africa in the Digital Age' dialogue were Harambee and CareerBox.

33   OECD (2015).

34   McCoy et al. (2017); Wolf and McCoy (2019).

35   Wolf, Aber and Behrman (2018).

36   Pathways for Prosperity Commission (2019a).

37   Muralidharan, Singh and Ganimian (2019).

38   Pitchford, Chigeda and Hubber (2019).

39   Cristia et al. (2017); Mansoor and Williams (2018).

40   For more information on VISHWAS see Centre for Education Innovations (2018).

41   See Pathways for Prosperity Commission (2019a) and The Economist (2018) for more on education systems.

42   Castaño-Muñoz, Colucci and Smidt. (2018) discuss Funzi in the context of training for migrant communities in Europe, but the application is also used across Africa to provide free modules on professional skills.

43   Graft, Verhulst and Young (2016) provide a case study on Brazil's budget transparency portal, while Clare et al. (2016) describe Slovakia's open procurement.

44   Although digital technology can certainly help in communication and dissemination, analogue channels can also successfully promote the distribution of information. In Tanzania, where low internet access constrained access to information, an effective distribution channel was to print out information from the open data dashboard and post these on community noticeboards. (McMurren, Young and Verhulst, 2017).

45   For example, Swaminathan et al. (2019) published a report of Indian child malnutrition with information at the level of parliamentary constituencies. The report triggered an important debate in the press on the issue before the 2019 general elections.

46   Smith (2013).

47   See Hattotuwa (2018) for an overview of social media in Sri Lanka, and Rocha Menocal (2018) for an overview of the new digital public square.

48   World Bank (2016).

49 As reported by Norheim-Hagtun and Meier (2010), since its inception in Kenya – where it had 45,000 users – the Ushahidi platform has been used in 300 different instances worldwide, including as a humanitarian aid tool in Haiti; by human rights groups in the Democratic Republic of Congo; to monitor elections in India, Mexico, Afghanistan, and Sudan; and by aid workers in the Philippines and Colombia. For more details on Ushahidi, see Mutahi and Kimari (2017).

50 For a discussion of the risks of government surveillance, see Richards (2013). For a discussion of how private firms use data, see Zuboff (2019).

51 See Yesil and Sözeri (2017) for a report of surveillance policies in Turkey, and Grinberg (2017) for a discussion of how similar policies in Ethiopia limited internet and phone usage.

52 An internal audit of the UN World Food Programme found major weaknesses and risks in the digital system that was used to register and manage over 24 million beneficiaries around the world. For more details, see World Food Programme (2017).

53 A discussion of issues around data collection and quality in developing countries can be found in OECD (2017a).

54 For more details on algorithmic bias detection and mitigation, see Turner Lee, Resnick and Barton (2019).

55 Indeed, during the first industrial revolution in Britain, despite strong economic growth, living standards actually declined for some labourers, and did not improve for generations. The economic transformation brought uneven growth that took decades to work through the rest of the economy. See Frey (2019), Voth (2003) and Allen (2009) for more details.

56 Bastagli et al. (2016).

57 International Monetary Fund (2019).

58 Social assistance includes cash transfers, non-contributory social pensions, food and in-kind transfers, school feeding, public works programmes (e.g. cash for work, or food for work), fee waivers and subsidies, scholarships, and assistance with social care. However, social assistance does not include unemployment benefits, which are classified separately. See World Bank (2019d) for more details on indicators of resilience and equity.

59 Olken and Pande (2012).

60 For a discussion of a range of humanitarian programmes, see International Rescue Committee (2016). For a discussion of the administrative costs of cash transfer programmes, see Caldes and Maluccio (2005).

61 In Argentina, linking 34 social programme databases to the unique identification number of beneficiaries identified inclusion errors and saved US$143 million. In Ghana's Labour-Intensive Public Works scheme, the switch from analogue to digital transactions and biometric identification reduced wage payment time from four months to a week. See World Bank (2019a) for more details on these and similar initiatives.

62 OECD (2019b).

63 The M-Pesa cash transfer project had a positive impact on household assets, consumption, food security, and psychological well-being, although it was seen to have no impact on health and education. For more details see Haushofer and Shapiro (2016). See Chapter 5 for more on mobile money services.

64 For data about Brazil, see Moss, Lamber and Majerowicz (2015). In Pakistan, biometric identification was used to ensure that benefits went to the intended recipient. More details can be found in Alliance for Financial Inclusion (2018).

65 For more details on SCOPE, see World Food Programme (2019) and World Food Programme (2014).

66 For a cross-country assessment of targeting versus universalism in social protection schemes, see, for example, Nelson (2007), Marx and Van Rie (2012) and Leubolt, Fischer and Saha (2014). Further discussions on consequences of behavioural conditionality (obligations imposed on beneficiaries) can be found in Das et al. (2004), Standing (2011), and Martinez Franzoni and Voorend (2012).

67 Making a benefit universal may be costly, but in actual fact, the increase in total recipients of universal basic income (UBI) may be minor in countries with very high rates of extreme poverty, where most people would receive a targeted payment, if one existed. There are few examples of UBI programmes being fully rolled-out and most of the debate is based on simulated data or small pilots. See World Bank (2019a) for more details, and for a preliminary assessment of an unconditional cash transfer programme, see Banerjee et al. (2019).

68 Forde, Rasanathan and Krech (2011).

69 See Packard et al. (2019) for a white paper on how risk-sharing policies may need to adapt to the changing nature of work.

70 Moss, Lambert and Majerowicz (2015).

71 As the digital age progresses, governments and donors will continue to face competing demands for finite funds. Given the immediate effect of cash transfers on alleviating poverty, these programmes may serve as a benchmark against which to measure other social programmes. If a programme does not deliver as much benefit as simply giving the cash to people in poverty, then it may be a candidate for phasing out in order to fund cash transfers.

72 Hjort and Poulsen (2019).

73 For more on access to energy, see World Bank (2018a) and for data, see World Bank (2019c).

74 Load shedding is the deliberate, coordinated shutdown of power in parts of an electricity distribution system. It is usually undertaken to prevent the failure of the entire system in periods of insufficient supply.

75 GSMA (2016).

76 See Dave (2019) for a news report of this initiative. Despite enthusiasm in Kenya, telecommunications providers in other countries are reportedly wary of Loon's technology – they do not want to purchase an infrastructure service that may not deliver on its promise.

77 This included some people who were not previously connected to the internet (see Murphy, 2018).

78 A guaranteed market may follow a similar model to that of the advanced market commitment (AMC) mechanism for vaccines (GAVI, 2019). The launch of the AMC programme in the 2000s vastly increased the market size for companies, effectively de-risking the market, and commensurately increased the reach and quality of vaccines, enabling life-saving products to reach the poorest. For more on the application of this model to digital technologies, see Digital Impact Alliance (2018).

79 Data extrapolated from OECD (2017b) and AidData (2017).

80 Tyson (2018).

81 'Microservices' refer to small functions (such as confirming a citizen's identity, transferring money, or identifying a location on a map) that can enhance another service. They can be purchased from or made available by other suppliers. For example, a firm that does not want to employ machine-learning scientists to develop a text-recognition algorithm can instead purchase a microservice from Amazon to do this. See Pathways for Prosperity Commission (2018a) for more.

82 Katel and Mergel (2018).

83 Language computing services (such as natural language processing and translation services) have not been developed for many languages, rendering simple tasks (that English-speakers may take for granted) impossible in many contexts and limiting the range of services available to entrepreneurs. See Cvitkovic (2019) for an analysis of this and other gaps in African data for machine learning.

84 International Telecommunication Union and Digital Impact Alliance (2019).

85 Pathways for Prosperity Commission (2019a).

86 For more information, see International Telecommunication Union and Digital Impact Alliance (2019).

87 For example, one in two women in low-income countries does not have an ID, limiting the ability of females to participate in economic and political life (World Bank, 2018d). For more on legal identity around the world, see World Privacy Forum (2017). In addition, note that the UN's Sustainable Development Goals include legal identity for all (Target 16.9).

88 Stuart et al. (2016).

89 Due to international standards, financial institutions – including mobile money providers – are required to establish effective customer identification, verification and due diligence. These procedures are known as 'Know Your Customer', or KYC, and mean that financial service providers must be able to accurately identify new customers and collect sufficient information to assess the risk of their engagement in illicit finance. For more, see GSMA (2019) and World Bank (2017a).

90 Misra (2019).

91 USSD (Unstructured Supplementary Service Data) is a menu-based technology, which works similarly to SMS, but the messages are sent between the user and mobile network, rather than between users. GSMA (2018) discusses the use of USSD for development.

92 Ndung'u (2019).

93 It is worth noting that many successful foundational digital systems, such as M-Pesa in East Africa and GCASH in the Philippines, are dominated by one actor. This does not mean that the presence of such systems cannot be in the public interest, but it does necessitate good governance and regulatory measures for such operations in a country.

94 Figures are from World Bank (2017a) and Aguera (2015).

95 Low mobile money penetration is often partly a result of strict regulations as to who can provide and use mobile money services. This has been the case in Egypt and in much of Latin America, although some countries have amended their regulations to allow new market entrants (see GSMA, 2017). Nigeria and Ethiopia also have very low mobile money penetration, and are also two of the countries with the highest number of people in extreme poverty (see World Bank 2018b).

96 For more on ID system design, see International Communications Union (2018). On the risks around digital ID, see Access Now (2018). We should also note that the present situation for those who are unable to prove their identity also entails a risk of identity theft or misuse. Universal digital identification would help with this problem.

97 Misra (2019).

98 There are various bodies proposing helpful principles for good digital ID. Examples include: World Bank (2018c) and Good ID (2019), but these do not go as far as to provide technical specifications. See endnote 100 for information on MOSIP, which is starting to fill this gap.

99 Phillips et al. (forthcoming).

100 MOSIP, or the Modular Open Source Identity Platform, is designed to help governments to implement their own cost-effective digital ID systems, with best practice for privacy, security, and scalability (see MOSIP, 2019, and Bhadra, 2019). Mojaloop is open source software for creating digital payment platforms. It establishes a blueprint, bridging all the financial products and applications in a market or economy, rather than being an application in its own right (see Mojaloop 2019).

101 GSMA (2015a).

102 The availability of private equity financing varies greatly. For example, India has quite a developed venture capital system, but this is not the case in most of sub-Saharan Africa, or indeed in other places, such as Peru (see Zavatta, 2008). That said, investment in start-ups has been growing: in Africa, tech start-up investment has increased from US$129 million in 2016 to US$334.5 million in 2018 (Disrupt Africa, 2019).

103 Data is from Strachan Matranga, Bhattacharyya and Baird (2017) on venture capital in Africa. This is not necessarily a problem in individual cases: the presence of a firm, even if foreign-owned, can benefit the local economy (for example, e-marketplace Jumia has significant impact on African business and jobs, despite being German-owned). However if investors are using heuristics like nationality or university prestige to judge applicants, then many good ideas are likely being underfunded.

104 See CDC Investment Works (n.d.) for an example of a DFI investment in venture capital in India. However, this still requires DFI shareholders – often donor governments – to allow the DFI to invest in these vehicles, which may have higher overhead costs.

105 See Strachan Matranga, Bhattacharyya and Baird (2017) or Halvorson-Quevedo and Mirabile (2014) for a more general treatment of the concept of financial guarantees in development.

106 Zavatta (2018).

107 This could be an area of opportunity for philanthropic funders: private-sector development currently constitutes only 3% of philanthropic spending (OECD, 2018).

108 Of course, this is not only for governments private sector entrepreneurs can try to fill these gaps too. Kenyan star-tup OkHi is aiming to provide validated and trusted addresses to fill this gap (Ndemo and Weiss, 2017). This may also be an opportunity for technology hubs and incubators to contribute, or to partner with government agencies.

109 Pathways for Prosperity Commission (2018a).

110 It is worth noting that even where people are connected to the internet, digital usage varies in different socioeconomic groups. The marginalised tend to use functions like the internet and text messaging less frequently and less intensively than the rest of society. (Pathways for Prosperity Commission, 2018b).

111 Pathways for Prosperity Commission (2018b).

112 Based on analysis of data from International Telecommunication Union (2019). Note: these statistics are largely based on self-reporting from government ministries and telecommunications authorities.

113 According to research by the Alliance for Affordable Internet, only 24 of 61 countries studied met the '1 for 2' standard in 2018. This translates to 2.3 billion people living in countries where internet is unaffordable. See Alliance for Affordable Internet (2018) for more details.

114 International Telecommunication Union (2013).

115 In one country, USF money was used to fund 103 towers, but 77 remain out of action because of lack of continuing funding – see Song (2019) for more. USFs are an example of hypothecation: a fiscal policy that assigns specific revenues to be spent on specific programmes or policies. Hypothecation is generally considered to be poor practice, as it limits the government's ability to properly balance trade-offs and prioritise competing issues, and it can sometimes lead to unaccountable 'slush funds'.

116 Large companies may also be able to create geographical cross-subsidies across borders, offsetting costs for connecting remote or poorer populations from more profitable business operations.

117 Online platforms, notably Facebook, have also offered 'Free Basics' data packages in low-income markets. However, concerns have been raised over the neutrality of this means of accessing the internet. Indeed, some users have mistaken Facebook for the internet (Song, 2017). Freemium models (otherwise referred to as 'Universal Basic Internet' or 'Free Basic Internet' models) offer a platform-neutral alternative – see Esselaar, Song, and Stork (2017) and Song (2017) for more.

118 Such pricing theories have long been the subject of ongoing debate. For more, see Ahmed, Trimble and Yoshida (2013) and Li, Wang and Yi (2018).

119 Box 4 is largely based on analysis in May and True (2019).

120 If backhaul connectivity is in place, there is an opportunity to provide users with very low-cost, time-based packages for internet connectivity. For example, Poa! Networks of Kenya offers users the ability to buy an hour's access for as little as $0.10. Such packages are priced in such a way that they provide options for those who cannot afford more expensive, traditional packages.

121 Zero-rating services are usually funded by the private sector and provide access to limited content free of charge or at reduced cost. However, there are drawbacks, not least that it presents issues around freedom of internet, does not support a competitive marketplace, and often does not support local content provision.

122 See Esselar, Song, and Stork (2017) and Song (2017).

123 This can lower costs for providers and consumers, increase market competition, and expand coverage footprints, but it is dependent on incumbents agreeing to partnerships and sharing agreements with competitors (May and True, 2019).

124 Jio was able to do this because any losses could be covered by its parent company (Reliance Industries Limited) which operates in many other sectors. Reliance is India's second largest company, and therefore is in a stronger position to voluntarily implement such cross-subsidies than smaller organisations.

125 These business models may prove sustainable if the demand from paying users is relatively insensitive to price. That is: if enough paying users are happy to pay a little bit more without switching, then the provider can offer subsidised access to poorer customers (eg freemium accounts, zero rating, or public wifi). Some of these customers will migrate into the paying group, and the subsidy continues to act as an onboarding instrument.

126 For more information on barriers to connectivity and ways of overcoming them, see May and True (2019).

127 In Tanzania, the overall effect of the subsidy was found to be quite small (Peng and Poudineh, 2016). In Columbia, subsidised customers received variable voltage, increased chances of power outages, and fewer infrastructural updates (Li, Wang and Yi, 2018). Further, governments must learn from past failures when considering utility subsidies (see International Monetary Fund 2013) for a review of energy subsidies in Africa).

128 Spectrum licences (granted by the national government) confer the right to broadcast wireless radio signals on a certain bandwidth or range of frequencies. Since there are only a limited number of usable frequencies for mobile communication, they must be carefully allocated.

129 These can be completely open auctions, or in some cases, they are competitive evaluations (sometimes called 'beauty contests') in which the price offered by the MNO may be only one factor assessed among others, such as geographic scope and inclusion strategy. See Riaz (2016) and Prat and Valletti (2000).

130 While auctions can be an effective means of allocating spectrum, poor design or implementation can lead to failure, undermining competition in the market, or failing to attract bidders, where pricing is too high. For example, the 2011 spectrum auction in Mozambique attracted no bidders (Vodafone, 2014). In 2016, excessively high reserve prices meant that part of or all digital dividend mobile spectrum went unsold in Ghana, Senegal and India (GSMA, 2017).

131 For lower spectrum pricing in underserved areas, see the case of Nigeria in Elix-IRR (2015). Sweden operates a minimum coverage obligation in its auctions (see GSMA, 2015b), while Denmark only allows bids that fulfil coverage obligations (Siong, 2012).

132 Song (2019).

133 Seturi and Kochlamazashvili (2018).

134 This is broadly in line with the hierarchical access model, which allows secondary users to access licensed spectrum on the condition that no harmful interference is caused to the primary users (licensees). See Hong et al. (2009).

135 Backhaul is the connection between a local cell tower and the rest of the network. In rural and remote locations, it is the most expensive part of connectivity (GSMA, 2016). On TVWS: it should be noted that some of these projects are risky, as they may not be able to continue if the license-holding TV stations decide to broadcast on these frequencies (World Bank, 2019b).

136 May and True (2019).

137 Schrader, Freimann and Seuring (2011).

138 For more on the 'poverty penalty', see Banerjee and Duflo (2011) and Mendoza (2008).

139 Wyche, Simiyu and Othieno (2016), and Baah and Naghavi (2018).

140 Such centres of expertise are often based in university innovation and design labs. For more information see Jagtap (2019).

141 Lunden (2019).

142 See Food and Agriculture Organization of the United Nations (2013) for information on Sokopepe, and InfoDev (n.d.) for information on Ghana's Farmerline.

143 World Bank (2019b).

144 M-Kopa solar cells have reportedly been installed in more than 600,000 households across Africa – most of which are in extreme poverty. Estimates suggest M-Kopa solar cells will generate 75 million hours of lighting per month, saving the customer base a total of US $450 million in kerosene costs over four years. (Ndung'u, 2019).

145 According to an analysis by Suri and Jack (2016), M-Pesa mobile money services lifted 2% of Kenyan households out of poverty.

146 Gibson (2016).

147 For more on the practice of measuring social impact, see Impact Management Project (2019), International Finance Corporation (2019), and Global Impact Investing Network (GIIN) (2019).

148 See Pathways for Prosperity Commission (2018b) for a further discussion of how gender affects tech usage; Barboni et al. (2018) for mobile phone ownership usage in India; Bailey (2017) for mobile money use in Bangladesh; Vodanovich, Urquhart and Shakir (2017) for computer use in the United Arab Emirates; Lwoga and Chigona (2017) for telecentre use in Tanzania; and Terry and Gomez (2010) for a global perspective on public internet access. Note that telecentres are public places where people can access computers, the internet, and other ICT services.

149 For example, in India, women report being more comfortable using WhatsApp to communicate than Facebook, because they thought the latter was too open to strangers and content that could be reputationally damaging. For more on how these norms shape usage, refer to Terry and Gomez (2010) and Barboni et al. (2018).

150 Moorhouse (2017).

151 Mudliar (2018).

152 Smith, Turpin and Herselman (2019).

153 Pathways for Prosperity Commission (2018b).

154 When girls had equal inheritance rights, families tended to invest more in their education (Deininger, Goyal and Nagarajan, 2013). Payments to delay marriage were much more effective at keeping girls in school than a six-month 'empowerment programme' (Buchmann et al., 2017).

155 See Bursztyn, González, and Yanagizawa-Drott (2018) for the Saudi Arabian example, and Bicchieri and Dimant (2019) for a more general discussion on using 'nudges' to change social norms.

156 Alliance for Financial Inclusion (2018).

157 In India, stereotypes about female leadership and perceived roles changed in villages that were randomly allocated to be under a female local council leadership (Beaman et al. 2009). Indeed, varied levels of exposure in rural and urban areas determine the pace of social change. Evans (2019) also attributes the greater pace of change in cities to more economic opportunities for women and more avenues to challenge established practices.

158 See Ferrara, Chong and Duryea (2008) and Jensen and Oster (2009) for studies that investigate the use of popular television to change gendered behaviour. In Pakistan, a women-only Facebook group called Soul Sisters reportedly has over 180,000 members. The group is largely used as an informal support network for women to seek and offer advice.

159 Pathways for Prosperity Commission (2019c).

160 Eisenmeier (2018).

161 Greenacre (2018).

162 For more information on governance challenges, see Pritchett, Woolcock and Andrews (2010); Pradhan (1996); Hulten and Isaksson (2007); and Kaufmann, Kraay and Mastruzzi (2011).

163 For example, based on current trajectories, on average, the 15 countries with the lowest level of state capabilities in 2008 would take over 650 years to reach Singapore's current level of state capability (Pritchett, Woolcock and Andrews, 2013).

164 Pathways for Prosperity Commission (2019a).

165 Bosworth (2017).

166 For more information on land registration in Pakistan, see World Bank (2017b).

167 See World Bank (2016).

168 Naydenova (2016).

169 For more information on the effectiveness of Muso's community case management approach, see Johnson et al. (2018) and Whidden et al. (2018).

170 Doctors simply place the order via WhatsApp and when the drone is within a minute from the hospital, they receive an SMS informing that the drone is about to dispatch the package through a parachute. For more details, see United Nations (2018).

171 For more information on the effectiveness of adaptive learning systems, refer to Evans and Popova (2016), and for more detail on Geekie, refer to Sakowski and Tövolli (2015).

172 Mittal, Mukherjee and Gelb (2017).

173 PARIS21 (2019).

174 For more detail on these recommendations, see Chapter 5 of Pathways for Prosperity Commission (2019a).

175 Gal and Rubinfeld (2019).

176 For instance, India's District Information System for Education collects almost 1000 educational indicators, but none of them actually measure learning outcomes (Pritchett 2018).

177 For more on mTrac in Uganda, see SDSN TReNDS (2018), and for SMS for Life in Tanzania, see Barrington et al (2010), and in Kenya, see Githinji et al. (2014).

178 See United Nations (2016) and Hernandez and Roberts (2018) for more information. See Bloom et al. (2017) for an overview of healthcare digitalisation. The authors find that in Bangladesh, the poorest people were least likely to benefit from online health information.

179 UNICEF Innovation (2015) provides more information about 'Prospera Digital', a Mexican cash transfer programme that includes information delivered by SMS. SMS-based education tools such as TextTETEA in Tanzania (Muralidharan, Singh and Ganimian, 2019) and Eneza Education in Kenya, Ghana and Cote d'Ivoire can reach people who only have feature phones (non-smart phones) and no internet access. Refer to United Nations (2018) for a broad survey of digital government.

180 See Tuti et al. (2016) for more on how the REDCap clinical information network improved paediatric data, and Kumar, Paton and Kirigia (2016) for PaperEMR's standardised checklists for medical examinations. PaperEMR's product codifies standard protol (helping ensure the right clinical steps are taken). It is designed to be scanned by a smartphone and converted into a database, and is presented on a rubber stamp which allows doctors to integrate it into their existing notebook and workflow.

181 See De Kock et al (2016) for a report by the Boston Consulting Group which claims that 70–80% of IT projects either fail outright or disappoint by running over time or over budget.

182 See recommendation 10 of the Commission on State Fragility, Growth and Development (2018) for details on how economic institutions can help fragile states. For more details about tax collection reform, see ICAEW (2019) and Pomeranz and Vila-Belda (2019).

183 See, for example, Ranchordás (2015a) for a discussion on regulating the 'sharing economy'.

184 In England, the Red Flag Act of 1865 limited the speed of the car to 2 mph in towns and 4 mph on the open highway, and required one person to walk in front of it with a red flag or red light – a blunt legislation which stifled the development of British road transport, compared to the United States, until 1890. See Clothier, Fulton and Walker (2008) and Flink (1988) for more details.

185 For example, in 2017, Benin enacted its 'Code du numérique', a comprehensive digital legislation akin to the EU's General Data Protection Regulation (GDPR), which updates parts of the country's previous data protection law from 2009. In Kenya, the National Payment System established an accelerated bankruptcy regime that would enable users to receive funds faster should a mobile money operator become insolvent (Greenacre, 2018).

186 World Economic Forum (2015).

187 For more information on taxation in the digital economy, see OECD (2019c) and OECD (2014a). And for a more in-depth discussion of the challenges of taxation from the perspective of developing countries and how international coordination is relevant to solve them, see Pathways for Prosperity Commission (2019c).

188 Coyle (2018).

189 Armstrong, Gorst and Rae (2019).

190 See Eggers, Turley and Kishnani (2018) and Armstrong, Gorst and Rae (2019).

191 See Nelson, Howde and Smith (2008) for an example of how political demands around drought policy can lead to the opposite of an adaptive learning approach.

192 Ranchordás (2015b).

193 In Singapore, interested parties can test energy generation and distribution technologies in a live environment, but with limits on duration and scale (Energy Market Authority, 2017). In Malawi, a low-regulation 'drone corridor' was created in which international groups were invited to test their drone operations (World Economic Forum, 2018). In the UK, the Financial Conduct Authority can conduct live testing of new financial services (Jenik and Lauer, 2017).

194 Decker (2018).

195 Eggers, Turley and Kishnani (2018).

196 Cortez (2014).

197 Carvalho et al. (2017).

198 Mandel (2009).

199 Kamali and Randall (2017).

200 Pathways for Prosperity Commission (2019c).

201 United Nations (2019). The international community, including broad stakeholders such as the United Nations, World Bank and International Monetary Fund, could be instrumental in fostering such multilateralism and diversification of voices in the long term.

202 McGowan et al. (2018) and Geller (2018).

203 Pathways for Prosperity Commission (2019c).

204 Phillips (2019).

205 The need for regional south-south cooperation was mentioned as a key aspect for international governance by some of the experts who participated in the international government study (Pathways for Prosperity Commission 2019c).

206 Pathways for Prosperity Commission (2019c).

207 For a discussion of 'passporting' in the context of financial services, see Dalhuisen, J. (2019).