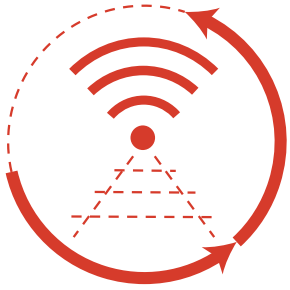


CHAPTER 5

National priorities

Analog foundations for a digital economy

Estonia is one of a handful of countries closest to becoming a digital society. After regaining its independence in 1991, it decided to promote the use of digital technologies in all areas of society and the economy. The nation was not rich by European standards, so one objective was to take advantage of efficiency gains. While investing in information and communication technologies (ICTs), Estonia also greatly improved its business climate, human capital, and governance. The greater ease of doing businesses spawned a host of technology-intensive startups, including Skype and TranferWise, a company disrupting the money transfer industry. The country today ranks high in the PISA (Programme for International Student Assessment) educational rankings and invests in digital literacy for its older citizens. The greater accountability in government boosted it from 78th to 40th between 1996 and 2010 on a ranking of 144 countries on their control of corruption. Today, Estonians have access to 3,000 e-government, e-banking, and other services, saving each of them an average of 5.4 work days a year.[1]

Estonia demonstrates that even small and developing or transitioning countries can seize the opportunities the internet offers by implementing a smart and comprehensive digital development strategy. Many other countries have also eagerly invested in digital technologies but have failed to create the environment for it to support development. So, while the internet has spread rapidly, development has advanced much more slowly. Chapter 4 discussed policies that ensure universal, affordable, safe, and open access to the internet. These supply-side policies are critically important, but are not enough.

Why is technology by itself unlikely to solve persistent development problems? The key insight is that a typical task in development has two broad parts: one that can be automated, and one that cannot. The automatable part of the task consists of repeatable, routine activities that produce measurable outputs and outcomes, and therefore are amenable to automation. Tasks performed by, say, bank tellers, bookkeepers, or clerks—and services such as registration and licensing—can to a large extent be done with digital technologies. In contrast, many tasks performed by teachers, researchers, or managers—and services such as policing or those performed in health care—involve activities where the providers must exercise considerable judgment in deciding what to do or how to respond. ICT projects often fail when they focus solely on technology without also addressing shortcomings in the complements that cannot be automated. The line that divides automatable activities from those that are not is, of course, continuously shifting. But solving the most difficult development problems will almost always require more than just technology.

Chapters 1–3 of this Report presented evidence of the problems that can arise from greater use of technology and identified the main risks that countries face as a consequence. To mitigate these risks, investments in digital technologies must be accompanied by improvements of their analog complements (figure 5.1):

- Lower-than-expected internet adoption means that many firms in low- and middle-income countries forgo considerable productivity benefits. The reasons include a poor business climate and vested interests that hinder market entry and reduce the pressure to innovate. Without improved regulations, especially those governing *competition*, economies of scale brought by the internet could well lead to harmful *concentration* and monopolies—and thus to greater divergence between and within countries, rather than convergence and catching-up.

- Rising shifts of income from labor to capital and the drop in mid-level jobs in many countries suggest that the gains from greater use of technology may not be equitably shared. Without complementary investments in the *skills* that workers need to leverage the internet, automation could exacerbate *inequality* rather than promote greater opportunity and shared prosperity.
- E-government projects have a poor record in many countries; governments have too often been unable, and sometimes unwilling, to use the internet to improve service delivery and increase public participation. Without more capable and more *accountable* public sector institutions, technology investments could lead to more *control* and not to greater empowerment of citizens.

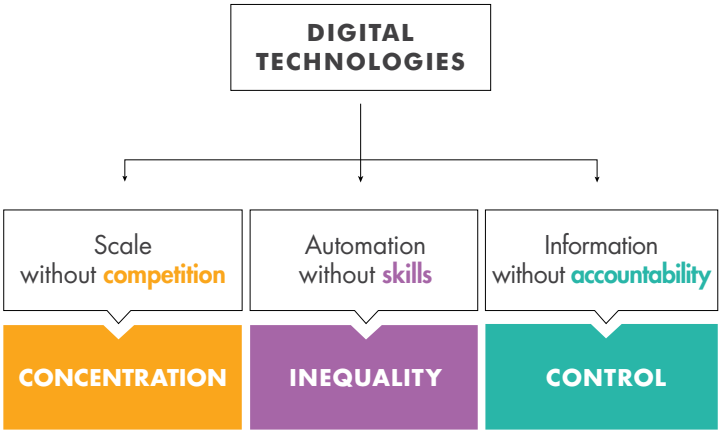
Business regulations that ensure a high degree of competition, skills that prepare workers for the 21st-century workplace, and accountable public institutions that use the internet to improve services—together these constitute the analog foundation that supports an inclusive, efficient, and innovative digital transformation.

The idea that technology alone is not enough to have a widespread impact on development is supported by a growing academic literature. Researchers focus on different angles, but come to similar conclusions (box 5.1). In a growth context, the level of analysis is a country or sector, and what matters is how technology interacts with rules—that is, with regulations and similar endowments. In a labor market context, the level of analysis is occupations or specific tasks, and what matters is the interaction of automation and worker skills. And in a government context, the level of analysis is a public service, and what matters for delivery is the accountability of institutions.

The interdependence between technology and complements

Technology and its complements feed on one another. Improvements in the business climate, human capital, and public sector governance are already high on the reform agenda in most countries. With greater use of technology, the complements also become more valuable because they interact. Thanks to technology, firms operating in a well-regulated business environment are more innovative. Skilled workers are more efficient. And accountable institutions are more inclusive. The internet thus tends to amplify existing strengths and weaknesses, and progress in these areas therefore becomes even more urgent. Otherwise, there is a risk of falling further behind for those who do not make the necessary reforms. As the following sections will show, technology does not just increase the value of complements. It can also often raise their quality—for instance, through online business registration programs, online education, or better monitoring.

Figure 5.1 Risks from digital technologies in the absence of complements



Source: WDR 2016 team.

So how can businesses, people, and governments reap the greatest digital dividends? The Report suggests many detailed steps to strengthen analog complements, but policy makers should also keep in mind a set of overarching principles concerning the interaction of technology and complements.

Guiding premises

The inability to scale up is one of the most commonly cited reasons for failed digital interventions

The popular media is filled with inspiring stories involving technology: digital marketplaces are helping artisans in remote hillsides to access global markets; the on-demand economy is creating new startups and digital entrepreneurs; and social media tools are helping citizens organize and rally around issues of common concern. But after a promising start, many initiatives seem to flounder. For every successful online commerce platform, nearly four fail to achieve scale. Despite the growing popularity of the on-demand economy, the firm startup rate in

Box 5.1 Three ideas about the interaction between technology and its complements

The relationship between technology and complements that is at the core of this Report is also the topic of recent work by a number of prominent researchers.

Technology and rules (competition). Paul Romer develops a simple growth model in which technology interacts with "rules"—including, importantly, regulations shaping the business climate. Technology is tradable and can spread to new places quickly. Rules are established locally. Even if they are negotiated internationally, they will not be simply imported like, say, capital goods. So there will always be a complex, context-specific political process that leads to their adoption and determines how effectively technology is deployed. Together, technology and rules enable the creation or adoption of new "ideas"—new or improved ways of producing, working, or serving citizens. The quality of rules varies across countries. Romer cites the municipal water sector privatization to a French company in Argentina to illustrate his argument. The program was initially successful, but—like in many other countries—eventually ran into popular opposition, which prompted renationalization. The technology required and the rules and preferences about regulating utility monopolies were present in France but not in Argentina. Technologies and rules were thus poorly matched. In contrast, ideas about setting up and operating mobile phone systems spread quickly to many countries—even to fragile states like Somalia. Mobile phone technology, in contrast to landlines or municipal water, easily allows competition among providers even in places with low regulatory capacity. For mobile, local conditions (or rules) have accommodated the new technology.

Technology and skills. David Autor is most concerned with effects of technology on labor markets. Looking at occupations and even individual tasks, he considers how much of a person's job is routine and could be done by a machine—and how much is nonroutine and not easily automated. Those tasks that follow easily codifiable procedures can be done by computers faster, better, and more cheaply. With increasing computing power and better software, the rule of thumb is that if you can fairly easily explain a job to someone, it can probably be automated. Tasks that require problem solving, adaptability, and creativity, in contrast, are very hard to automate. Again, the difficulty in automating a job tends to match the difficulty in describing it. Autor stresses the interaction of technology with nonroutine tasks. Nonroutine jobs cannot easily be automated, but they can benefit from automation because technology tends to complement skills. Workers in nonroutine jobs get more productive as the automation of other tasks increases.

Technology and discretion (accountability). Lant Pritchett, Michael Woolcock, and Salimah Samji focus on public services and develop a typology of organizational capabilities for specific public sector tasks. They do not specifically look at the role of technology, but their framework provides insights about when technology could improve services. Informed by the accountability framework in the 2004 *World Development Report, Making Services Work for Poor People*, their main criterion is whether a task involves local discretion and therefore some judgment by a civil servant. Others are whether a task is transaction-intensive, and thus involves many people; whether it is a service (education) or an obligation (policing); and whether it can draw on existing knowledge or requires innovation. Categorizing public service tasks in this framework helps explain why e-government efforts often fail—when organizational capabilities are poorly matched to technology and the requirements of the task.

These studies make very similar arguments. First, technology alone will not be enough. Second, increasing the use of technology needs to be matched by complementary reforms. And third, knowing the best combination of technology and complements for different tasks, occupations, and services is the key to translating technological progress into development.

Sources: Romer 2010; Autor 2014; Pritchett, Woolcock, and Samji, forthcoming; World Bank 2004.

the United States continues to decline, with the largest decline in the retail and service sectors.[2] And as the Arab Spring showed, citizen mobilizations based on social media are as easily crushed by governments as they were stitched together by citizen activists. All this because it is easy to scale up the technology, but difficult to improve its complements.

The internet is no shortcut to development, but it can be an accelerator

For policy makers, using technology to solve a problem is often more tempting than fixing an ailing institution. A manifestation of this is the popularity of distributing laptops to schoolchildren as an election pledge. There is also growing demand to wire

schools, hospitals, and all government buildings. Connectivity is important, but it is not enough. Technology can rarely bypass or substitute for other shortcomings. When technology is deployed in an environment of weak complements, the gains will be limited. But when technology and its complements work together, the impacts can be profound and lasting. While the internet is no shortcut, it can be an accelerator because many digital tools improve the complements.

Understanding the interaction between technology and human complements should guide how much to invest in each

Some sectors, occupations, and services are more amenable to technology than others (figure 5.2). Gains from technology will be larger in public services such as cash transfer programs and utility services—where outcomes can be easily monitored by citizens—than in services that require a lot of discretion, such as policing and management. Similarly, occupations involving routine tasks will be more affected by technology than those requiring a high degree of judgment and intuition. With technological advances, more tasks could become easier to automate, so the relative roles of technology and complements could change over time. Since outcomes are easier to monitor for private businesses, as a rule of thumb, firms are likely to be more successful than governments in using technology to solve problems. Thus in a weak institutional environment, the priority should be to encourage greater adoption of technology by the private sector, while continuing to strengthen the complements in the public sector.

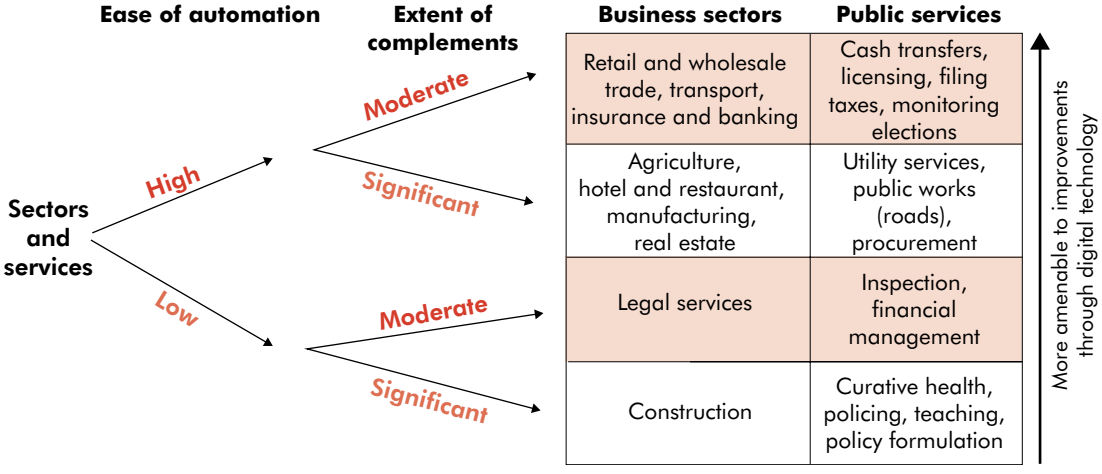
A digital strategy is more about the adoption of ICTs than their production

Many policy makers wish to have a Silicon Valley in their country, dotted with large ICT firms like Apple, Facebook, Google, Huawei, and Samsung. But the widespread adoption of ICTs, not their production, is responsible for most of the growth and job creation.[3] The ICT sector in developing countries is fairly small, accounting for only 3–4 percent of GDP and 1 percent of the total labor force. But when ICT firms enter traditional sectors such as retail, banking, manufacturing, and transport, they spur competition, raise productivity, and expand opportunities. For example, Alibaba has 30,000 employees, but provides a platform for more than 10 million ancillary jobs. Uber has a few hundred coders, but it supports the livelihoods of around 1 million on-demand drivers. The online outsourcing industry creates millions of freelancing opportunities in professional services. And in Mexico, manufacturing firms subject to competition from Chinese imports invest more in digital technologies, thus boosting productivity and creating more employment opportunities.

A digital strategy needs to be broader than an ICT strategy

The digital economy transcends the ICT sector, encompassing most sectors of the economy and society.[4] Yet many governments continue to treat the digital economy as a sector, with exclusive emphasis on developing ICT infrastructure and creating an information technology (IT) workforce. Our analysis shows that a successful digital strategy needs to stand

Figure 5.2 Some services and sectors are more amenable to digital technology than others



Source: WDR 2016 team.

on two pillars—one digital and the other analog. The digital pillar deals with the supply-side issues, focusing on policies to make the internet universally accessible, affordable, open, and safe (chapter 4). The analog pillar aims to strengthen the demand-side policies by creating regulations that encourage competition, basic modern skills for all, and public institutions that are accountable. Countries such as Rwanda, whose vision is to become an information-rich, knowledge-based society, have gradually tried to broaden their digital strategy to include both the digital and the analog foundations.[5,6]

A country typology for digital development

As digital development proceeds from emerging to transitioning and then to transforming, policy reforms become more complex. There are no hard-and-fast rules, but it is useful to consider a sequence of policy priorities in line with technology's increasing penetration (table 5.1):

- *Emerging countries.* In countries where the digital economy is still emerging and internet use is low, the priority is to lay the foundations: Remove barriers to internet adoption such as high duties on ICT capital imports. Improve the business climate, including physical infrastructure critical for online businesses with an offline footprint. Promote digital literacy and basic cognitive and socioemotional skills. Use the internet to provide information and monitor service providers.
- *Transitioning countries.* Countries transitioning toward universal internet use need to address harder problems: Build effective competition regulation and enforcement capacity. Teach advanced cognitive and socioemotional skills that complement technology. Move toward effective e-government systems.
- *Transforming countries.* Countries transforming into digital societies need to tackle complex problems: Regulate platform competition and privacy. Advance ICT and science, technology, engineering, and mathematics (STEM) skills and lifelong learning. Move toward ubiquitous e-government services and participatory policy making.

Classifying countries into various groups is necessarily somewhat ad hoc (figure 5.3). The labels applied in the following sections should therefore be treated with considerable discretion. Technology adoption and the quality of complements vary not only across countries but also across sectors and across firms in the same sector. So a country classified as emerging for its government institutions could be categorized as transitioning for its skills and as transforming for its regulations. Some sectors in a country could be transforming while the rest of the economy is emerging. So the boundary lines across country groups and complementary factors are more indicative than fixed.

Table 5.1 Policy priorities for emerging, transitioning, or transforming countries

Policy goals	Stage in the digital transformation		
	Emerging	Transitioning	Transforming
Regulations (competition): A business environment in which firms can leverage the internet to compete and innovate for the benefit of consumers	• Low barriers to internet adoption (including access, affordability, and basic open and safe issues; trade and basic competition issues)	• Effective competition regulation and enforcement (including ease of market entry)	• Critical "new economy" regulation (including platform competition and the legal basis for private sector data collection)
Skills: Workers, entrepreneurs, and public servants who can take advantage of opportunities in the digital world	• Digital literacy and foundational basic cognitive skills, and socioemotional skills	• Higher-order cognitive and socioemotional skills	• Advanced ICT skills and STEM education • Lifelong learning
Institutions (accountability): An accountable government that effectively uses the internet to empower its citizens and deliver services	• Adoption of informational services and monitoring by public sector and nonstate providers • Increased electoral accountability	• Effective e-government delivery systems, provider management, and citizen engagement • Trust and safeguards against privacy and security	• Widespread citizen use of e-government services and participatory policy making • Social protection systems for a changing labor market

Source: WDR 2016 team.

Note: ICT = information and communication technology; STEM = science, technology, engineering, and mathematics.

Figure 5.3 The quality of complements and technology rises with incomes

Sources: World Bank World Development Indicators (various years); World Bank Enterprise Surveys (various years); Gallup World Poll (various years); World Bank Global e-Government Systems database; World Bank ID4D database; United Nations 2014; WDR 2016 team. Data at http://bit.do/WDR2016-Fig5_3.

Note: Technology is measured by the Digital Adoption Index (DAI). DAI is based on three sectoral subindexes covering businesses, people, and governments, with each subindex assigned an equal weight: DAI (Economy) = DAI (Businesses) + DAI (People) + DAI (Governments). Each subindex is the simple average of several normalized indicators measuring the adoption rate for the relevant groups. Similarly, *complements* is the average of three subindicators: starting a business; years of education adjusted for skills; and quality of institutions. See figures 5.4, 5.8, and 5.10 for more details on the construction of sectoral subindexes.

Regulations: Helping businesses connect and compete

A competitive market encourages firms to use the internet to access new markets, increase productivity, and achieve scale. Firms in more contested industries—facing more domestic or foreign competitors and higher firm entry and exit rates—are more likely to adopt digital technologies (chapter 1). So those countries that are creating a level playing field for their businesses by embracing competition—by making it easier for new firms to enter and for existing firms to reorganize and exit, while preventing incumbent firms from acquiring monopoly power—are expected to perform well in a digital world.

The lack of competitive pressure and absence of basic infrastructure are holding back many firms in developing countries from taking full advantage

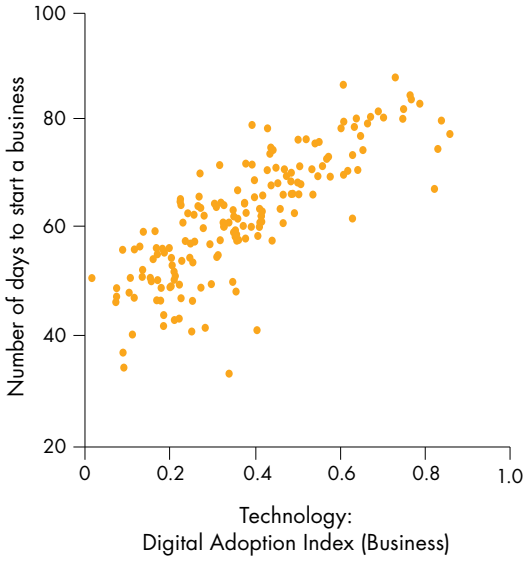
of the internet. It is not uncommon for incumbent firms to secure profits by seeking protection through regulatory means rather than by competing in the open market. The problem arises when policy makers oblige. There are also instances when regulations are genuinely outdated or reflect risk aversion to technological change and the consequent disruption. For example, regulators around the world seem to be conflicted on whether ride sharing services should be regulated as transport service companies or as software companies. Is mobile money a banking or a telecom product? And in highly connected markets, could the absence of competition across various digital platforms inhibit future innovation? In some low-income countries, the lack of supporting infrastructure—such as electricity, roads, ports, warehouses, distribution, and a well-functioning postal system—could hinder firms from investing in digital technologies.

Appropriate regulation at various levels of digital adoption

Policy reform priorities are likely to vary across countries depending on their level of digital adoption. Matching the country typology with appropriate regulatory reforms leads to the following taxonomy (figure 5.4):

- *Emerging countries* are characterized by low digital adoption and protected markets. They are also likely to suffer from poor infrastructure and weakly accountable institutions. Investing in basic physical and digital infrastructure (chapter 4); lowering tariffs on digital products; encouraging adoption of low-tech, disruptive applications such as mobile money and social media; and reducing product market regulations are some of the policy priorities these countries should consider.
- *Transitioning countries* have mixed regulations, with some sectors open to competition. Many of their business regulations are codified, easily available, and increasingly carried out online. These countries also have fairly good physical infrastructure. Transitioning countries thus need to remove regulatory barriers across major sectors to incentivize firms to invest in more efficient digital solutions and encourage the entry of startups that can put competitive pressure on incumbent firms. When required, they should establish regulatory clarity between online and offline businesses within the same sector. A majority of developing countries and some developed countries fall into this category.
- *Transforming countries* are open to competition in most economic sectors and generally have accountable and capable governments that provide good physical infrastructure and enforce business regulations that promote competition. But they face two distinct sets of problems. First, because they are early adopters of digital technologies, many of their firms have well-functioning but perhaps less productive and nonscalable "legacy systems." These countries would benefit from relaxing their regulatory constraints to level the playing field between incumbent firms and (internet) startups in all sectors, but especially in the legacy sectors. Second, given the universality of digital technologies, these countries have witnessed rapid growth of digital platforms in selected sectors, some of which have achieved a dominant position in their markets. They need to find ways to encourage greater competition across platforms: say, by eliminating exclusivity conditions and introducing portability and seamless transfers of data and information across platforms.

Figure 5.4 Regulations that encourage competition also facilitate higher adoption of digital technologies



Sources: Doing Business database (World Bank, various years); WDR 2016 team. Data at http://bit.do/WDR2016-Fig5_4.

Note: The Digital Adoption Index (Business) is the simple average of four normalized indicators: the percentage of businesses with websites, the number of secure servers, the speed of download, and 3G (third-generation) coverage in the country.

Emerging countries: Invest in infrastructure and enforce product market competition

For many lower-income countries, creating basic business-sustaining infrastructure is a priority,

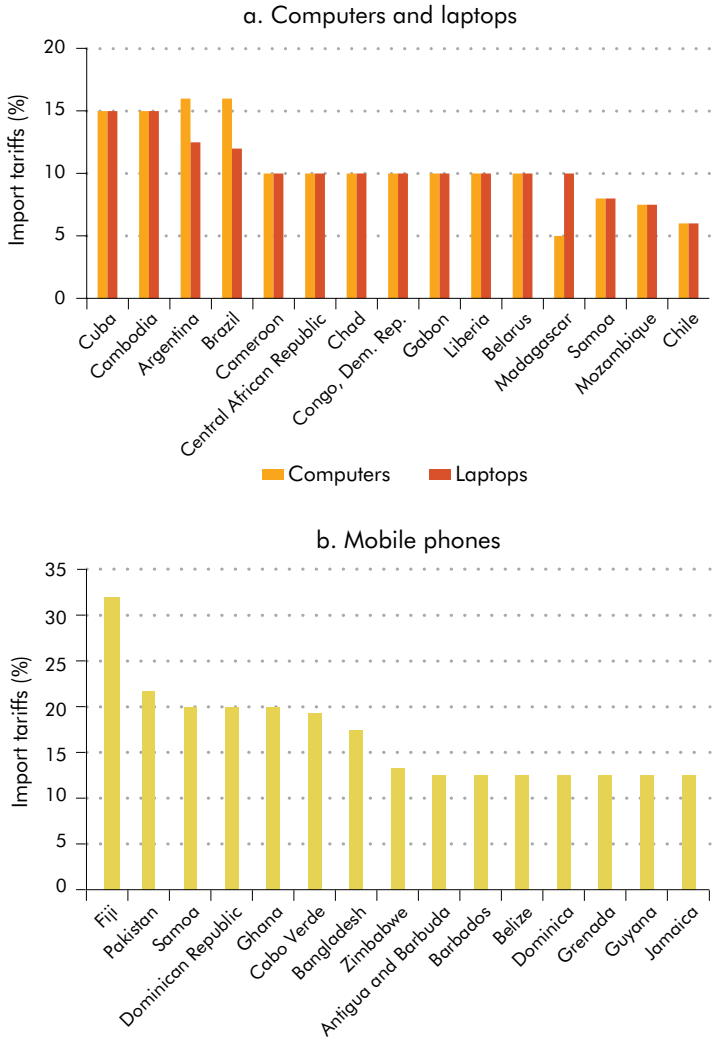
requiring finance, local expertise, and innovative solutions. Digital technologies can help overcome some of these problems. Revenues from telecoms—customs duties on hardware, auctioning and managing spectrums, and value added tax (VAT) or sales taxes on services—have been one of the fastest growing sources of revenue in many developing countries. But regulatory capture by powerful telecom firms could undermine this effort, as in Somalia. Many other countries in Africa, however, have the opposite problem—they have used the telecom sector as a "cash cow," taxing it so heavily as to impede its growth prospects. Even so, there are private sector solutions to financing and managing infrastructure services using digital technologies that hold the most promise. For example, Mobisol, a German company, is supplying off-grid energy to villagers in Rwanda by combining solar energy technology with mobile phone–based loan payments.[7]

Countries need to look at the digital economy as a source of growth and jobs and not just as a source of revenue. Some countries impose significant import tariffs on computers, laptops, and mobile phones to meet short-term revenue objectives (figure 5.5). For example, the most favored nation (MFN) tariff rate on computers in Djibouti is as high as 26 percent. Fiji charges MFN tariff rates of more than 30 percent for mobile phones. The tariffs on using digital technologies raise the costs of using digital technologies for firms and households, thus delaying the emergence of the digital economy and its attendant positive effect on growth and jobs. In general, the higher revenue buoyancy in the medium term can more than make up for short-term revenue shortfall from reduced tariffs.

In addition to electricity, countries need to invest in trade infrastructure and customs administration to improve physical connectivity and facilitate the growth of the digital economy. Several countries still have inefficient ports and other trade infrastructure. Among the weak performers on trade logistics in 2007, only a few significantly improved their trade logistics infrastructure between 2007 and 2014, including Afghanistan, Nepal, Nigeria, Rwanda, Serbia, and Tanzania (figure 5.6). Countries can also improve their overall logistics performance by lowering their nontariff barriers and tackling behind-the-border issues. Firms with improved logistics are better positioned to export their products and services using online marketplaces once these platforms gain in importance in their region. But several countries continue to lag behind, including Cameroon, the Comoros, Eritrea, Somalia, and Sri Lanka.

Another infrastructure constraint to a digital economy in emerging countries is the absence of domestic delivery systems. There were 38 countries in 2012 where less than 50 percent of the population had access to home postal delivery (see chapter 1). And several countries had no "last mile" domestic delivery system in place at all: Botswana, Burkina Faso, the Central African Republic, the Democratic Republic of Congo, Gabon, Kenya, Rwanda, Swaziland, Togo, and

Figure 5.5 Digital products are taxed as luxury goods in some countries

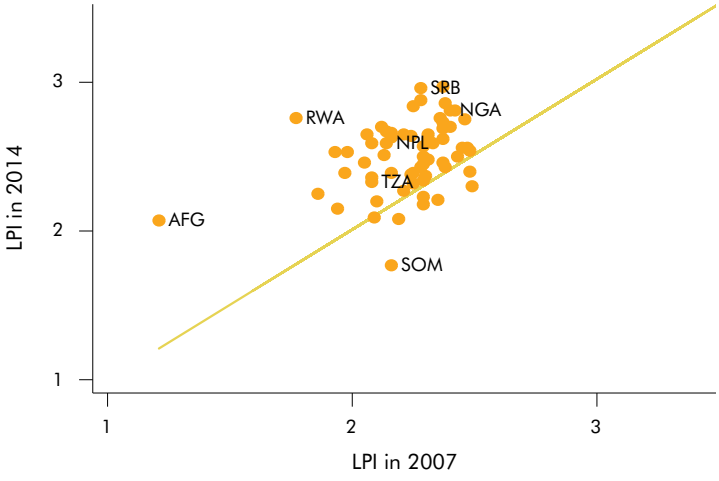


Source: WITS 2014. Data at http://bit.do/WDR2016-Fig5_5.

Note: Panel a shows most favored nation (MFN) tariff rates for computers and laptops. The Harmonized Commodity Description and Coding System (HS) code for computers is HS 8471.49, and the HS code for laptops is HS 8471.30. The MFN tariff for computers in Djibouti (not shown) is 26 percent. Panel b shows MFN tariff rates for mobile phones. For some countries, the MFN tariff rates may exaggerate the level of taxation, especially if they source a large part of their digital imports from Free Trade Agreement partners, as is the case with Chile.

Figure 5.6 Infrastructure complements

Trade logistics in many countries haven't improved in the past seven years



Source: World Bank Logistics Performance Index (various years). Data at http://bit.do/WDR2016-Fig5_6.

Note: The LPI (Logistics Performance Index) covers six areas of logistics: customs, infrastructure, international shipments, logistics quality and competence, tracking and tracing, and timeliness. The index varies from 1 to 7. The figure shows only those countries with relatively weak trade logistics in 2007 (index below 2.5). Observations above the yellow line indicate that countries improved their logistics performance between 2007 and 2014.

Tanzania. Online retailers in these countries thus struggle to deliver parcels to their customers and are forced to invest in their own logistics solution.

Reliable online payment systems are also not available in many African and Central Asian countries, limiting the potential for e-commerce. While most individuals in developing countries do not have access to a credit card, online payment systems for businesses, such as the PayPal business account, provide reliable alternative solutions. In several Latin American countries, small businesses that do not have a bank account can use PagosOnline for payments. Without reliable and legal online payment systems, firms have been resorting to riskier solutions, such as Bitcoin, as in Ghana. Not only are such activities illegal in some countries, but when undertaken on a large scale and in a weak regulatory environment, they could have a destabilizing effect on the financial sector.

Emerging countries should focus on enforcing existing business regulations and competition and antitrust laws. Most countries have laws that define some degree of competition or antitrust regulation but that are seldom enforced.[8] Moreover, business regulations are sometimes implemented in a way that discriminates between firms, increasing regulatory uncertainty. Agreements among competitors on setting prices, sharing markets, and bidding for public procurement, for instance, are one of the most common anticompetitive practices, even though most countries have competition laws in place.[9]

Emerging countries should thus focus first on reducing the implementation gap in enforcing existing laws. Required changes for implementation could be handled through secondary legislation or guidelines. Such changes include transparently defining appropriate fines for anticompetitive behavior, granting sufficient authority and investigating power to implementing agencies to fight anticompetitive regulations in all economic sectors, reducing anticompetitive practices by government agencies that facilitate cartel behavior, and measuring and communicating the harmful effects of cartel agreements to encourage support for competition policy.

Transitioning countries: Enhance competition by removing regulatory barriers and encouraging entry of internet startups in traditional sectors

Competition law and competition authorities

Anticompetitive regulations, while designed with good intentions, can be misused. Vested interests and privileged firms can use them to limit entry into domestic markets; to access government subsidies, contracts, or land; and to insulate them from foreign competition. Such anticompetitive regulations seem to discourage firms in some developing countries—including Brazil, the Democratic Republic of Congo, Ghana, Kenya, Mexico, Morocco, Tanzania, Uganda, Vietnam, and Zambia—from using digital technologies more intensively (chapter 1).

Most countries have a competition authority, though many were set up fairly recently, and enforcement varies, especially when the state or privileged firms benefit from market restrictions. Limited capacity and the difficulty of proving harm to consumers are further barriers. A priority for transitioning countries is to institute strong competition laws and boost the capacity of implementing institutions to enforce the law transparently and effectively. Policy measures include leniency programs allowing participants of cartels to cooperate with government bodies in exchange for lower sanctions—and ex post investigation of potential collusive practices in procurement.

Disruption as a strategy to create competition

Transitioning countries should encourage the entry of internet firms offering traditional services in order to disrupt protected sectors. The internet has created a new wave of entrepreneurship and innovation

around the world. Internet firms now compete with offline incumbents in banking, insurance, retail trade, transport, logistics, international currency transfers, accommodation, tourism, media, publishing, advertising, programming, design, and other professional service tasks.

Governments may consider abstaining from imposing regulatory barriers on new internet firms before they achieve a certain scale. Eliminating protection, often against the interests of influential elites benefiting from the status quo, is difficult and takes time. But internet firms can do the work of the regulators and introduce competition in a sector overnight. The mobile money service M-Pesa in Kenya was able to achieve scale because of the regulator's initial decision to regulate it as a telecom and not as a banking sector product. The mobile-money schemes in other countries have often been held up by opposition from traditional banks. At the same time, lack of adequate regulation on the telecom side meant that M-Pesa enjoyed dominant market power in Kenya for a fairly long time, which ultimately had to be curbed by the competition authorities. This highlights the tight-rope walk for regulators in the digital economy (box 5.2).

The internet firms operating in the financial sector are often not subject to the same level of regulations, enabling Yu'E Bao, an online trust fund in China, to enroll 150 million depositors and collect Y 700 billion in deposits in less than two years. It offered higher yields on the deposits by making use of underregulation of the financial sector outside the formal banking system. The ongoing reforms in the financial sector in China have narrowed this regulatory arbitrage.

Transforming countries: Encourage digital innovation but also regulate the digital economy to level the playing field between incumbent and internet firms

Critical "new economy" regulations

While most of the internet's impact will be in traditional sectors that use technology to boost efficiency, "pure" internet firms raise new challenges that regulatory authorities even in advanced economies

Box 5.2 Mobile money: A success story and yet a regulatory minefield

Mobile money started informally, with users making payments of airtime credit to each other (see also spotlight 2). This system is still operating in many countries, such as Somalia, where users exhibit more faith in storable and transferable credit than in the local currency, the Somali shilling. But elsewhere, notably in Kenya, a more formal system of mobile money developed, using a separate store of credit on the user's SIM (subscriber identification module) card. Safaricom introduced its M-Pesa mobile payment service in 2007, and other operators developed rival services. By 2013, transactions of US$21.9 billion—equivalent to just under half of Kenya's GDP—were transacted on mobile devices. M-Pesa was introduced two years later in Tanzania. Although initially slow to take off, it now equates to a higher percentage of GDP (53.2 percent) and will soon overtake Kenya in volume.

Safaricom had a monopoly in the Kenyan market for almost seven years. It had established exclusivity arrangements with M-Pesa agents, meaning the agents could only offer products and services within the M-Pesa network. Agents were thus locked in to a single operator, and so were most users. Since Safaricom controlled more than two-fifths of the mobile money transfer business, the exclusivity contracts with the agents posed an entry barrier for other telecom operators. One reason Safaricom justified keeping its network closed was that it had incurred high costs to develop the existing infrastructure.

Recently, the Competition Authority of Kenya ruled: "(a) that all restrictive clauses in the agreements between Safaricom Limited and its Mobile Money Transfer Agents be expunged immediately, but in any event not later than July 18, 2014; (b) that the Mobile Money Agents be at liberty to transact the Mobile Money Transfer Businesses of any other mobile money transfer service providers; (c) that oversight by Safaricom Limited be thereafter limited to its business with the Agents; and (d) that each Mobile Money Service Provider be responsible for ensuring compliance with Central Bank of Kenya Regulations."[a]

This ruling came weeks after M-Pesa permitted its agents to work with other mobile operators. Eliminating its exclusivity agreements reduced the cost of sending money from M-Pesa users to other unregistered users. For example, the cost of transfers of between K Sh 101 and K Sh 500 fell from K Sh 66 to K Sh 44 within six months after the end of the exclusivity agreement.

Sources: Plaza, Yousefi, and Ratha 2015, for the WDR 2016; Di Castri and Gidvani 2014.

a. http://africanantitrust.com/2014/10/09/antitrust-enforcer-subjects-mobile-payment-operator-to-central-bank-oversight/.

struggle with. Sharing economy firms like Uber and Airbnb scaled up traditional ride sharing and subletting to a global scale. But regulators struggle to determine whether these companies are taxi and hotel companies or simply software providers. Offline competitors complain that they do not follow the same regulations. Where these industries tend to be overregulated—often the case in the traditional taxi business, for example—this new competition can encourage a general regulatory overhaul of the industry.

Once internet firms offering traditional services achieve a certain scale, regulators need to modernize and impose sector-specific regulations to level the playing field between online firms and their offline competitors. New York City regulators started to require Uber drivers to be licensed, to drive vehicles with livery plates, and to have commercial insurance to create fairer competition between the sharing economy and taxi drivers. In other cases, requirements that taxi drivers have full knowledge of local streets have become obsolete with global positioning systems (GPS) and should be scrapped. Airbnb is required to pay local sales tax in several cities where its services compete with those of the hotel industry.

Creating competition across platforms

Concentration in the digital economy paired with network effects or switching costs can lead to anticompetitive behavior. But internet firms confound traditional competition law because they do not act as traditional monopolies. Their services are often free or more convenient for consumers. It is also less than straightforward to establish their real line of business. Google, known as a search engine company, is better described as an advertising firm. It accounts for nearly 90 percent of the online search market in some countries, and around 25 percent of the display-ad market, while Yahoo and Facebook account for about 10 percent each.[10] But given their dominance in the markets for online ads or books, some internet companies have considerable leverage over marketers and booksellers. This is similar to credit card companies' position with respect to retailers. Since many internet firms operate in two-sided markets, where an online platform brings together buyers and sellers, these internet intermediaries could blur price signals in either of the two markets. Research by economists such as Jean Tirole shows that regulations in such industries must be carefully tailored to ensure competition and not harm consumers.[11] These are very challenging problems. Countries could consider orienting their regulations to those under development in the European Union (EU) or North America.

Skills: Making the internet work for everyone

If you compared our world today with the world one hundred years ago, you would encounter amazing advances in science, commerce, health care, transportation, and other areas. But if you were to compare the classroom of a hundred years ago with an average classroom today, you would recognize it immediately: students lined up in rows, paper and pencil in hand; a teacher at the blackboard jotting down facts; students furiously copying all that is written and said, expecting to memorize the facts and spit them out on an exam.

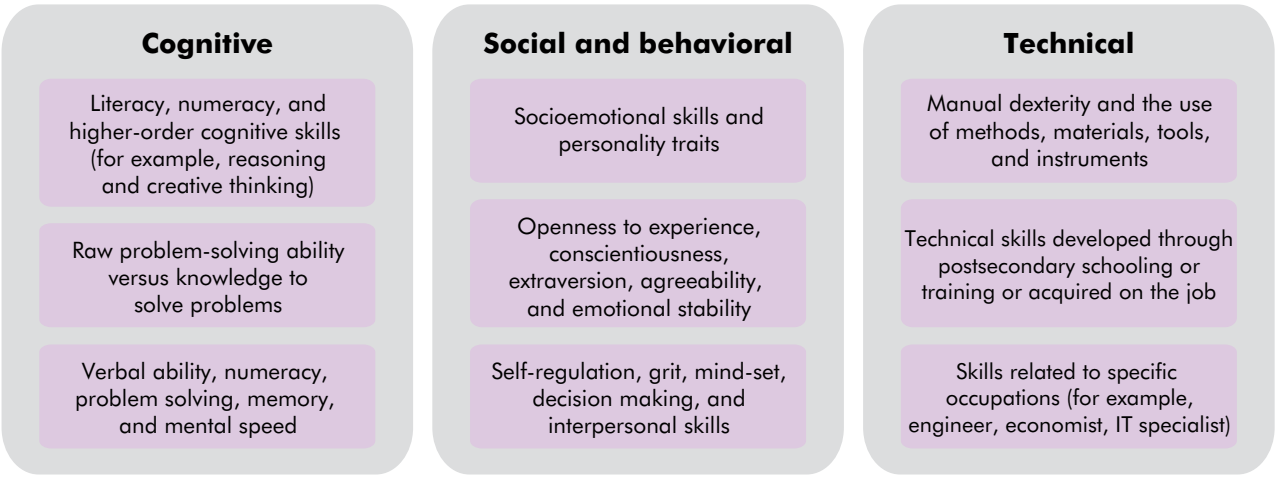
—Robert Hawkins (2002)

Technological changes are disrupting the employment landscape. Occupations are becoming more technology intensive, and "old economy" jobs are giving way to "new economy" careers. In many countries, this transformation is just starting and will take time. But even in these countries, the time for action is now. Changes in education and training take a generation to have an effect, and reforms need to start early so that skills do not become a bottleneck as countries advance in their digital transformation.

A changed world with unchanged classrooms

The skills mix needed to succeed in the labor market is changing, and today's education and training systems are often failing to keep up. The use of digital technologies requires basic cognitive skills, such as literacy and numeracy. But a well-educated worker in the 21st century also needs skills that are easily transferable across jobs and occupations and that help respond to changing labor market demands: higher-order cognitive, socioemotional, and technical skills (figure 5.7). This multiplicity of skills has always been important, but it is now essential. From Lebanon to Peru to Vietnam, employers are looking for workers who work well in teams and can solve problems, think critically, and present their work well to others.[12] Yet in many countries, education systems fail to provide even basic literacy and numeracy. More than half of 15-year-olds are functionally illiterate in middle-income countries such as Albania, Indonesia, Jordan, Kazakhstan, Malaysia, and Peru.[13]

Figure 5.7 The types of skills needed in a modern economy



Source: WDR 2016 team, adapted from Pierre, Sanchez Puerta, and Valerio 2014.

Note: IT = information technology.

Digital technologies accelerate the pace of labor market changes, opening new opportunities but also making skills obsolete more quickly. This calls for more adaptability from individuals and institutions, a stronger link between educational and training institutions and the private sector, and policies that promote lifelong learning. Since skill development starts at birth and is lifelong, a life-cycle approach to learning is necessary.[14]

These two labor market transformations—changing skill mix and rapid skill obsolescence—have profound implications for the skill development agenda. While digital technologies affect the whole skill formation process by changing the role of teachers, how students learn, and the mechanisms to strengthen accountability in education and training (see sector focus 2), priorities for skill development in the 21st century hinge on three questions:

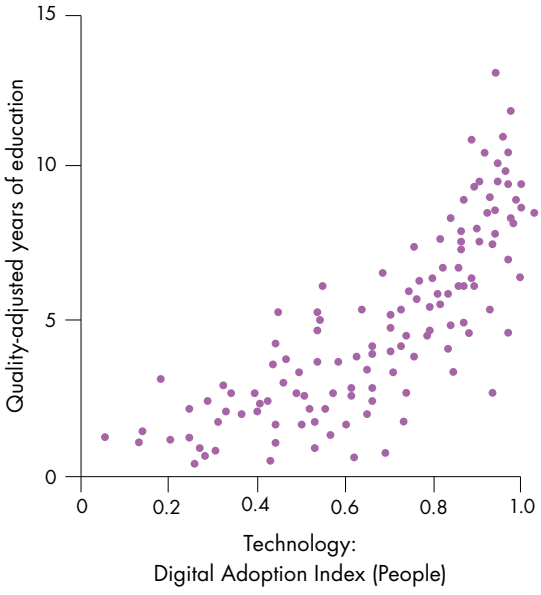
- What are the policies and interventions needed to provide current and future workers with skills for a digital economy?
- How do these priorities vary by each country's labor market challenges and skill base?
- How can digital technologies complement this "analog" policy agenda?

Priorities for a skill development agenda in the 21st century

Countries with strong skill development systems are best prepared to leverage digital technologies, to manage some of the labor market disruptions that technology creates, and to ensure that the benefits of digital technologies are widely shared. In emerging digital countries, such as Nepal or Senegal, the skill base remains weak, with gaps in foundational cognitive and socioemotional skills, as well as in basic digital literacy. Transitioning countries, including Armenia, Sri Lanka, and Ukraine, have done fairly well on foundational skills, but they face the challenge of keeping up with some of the new skill demands arising from digital technologies, especially higher-order skills. Transforming countries, such as the Czech Republic and the Republic of Korea, are best positioned to think about more advanced technical skills (both in ICT and in STEM), and, since many of their citizens are also rapidly aging, also need to prioritize lifelong learning (figure 5.8).

Every country has multiple skill development systems. As international tests make clear, individuals who perform best in less advanced economies are often at par with peers in more advanced countries, and there is a lot of inequality in outcomes within countries.[15] So a simple sequencing of policy reforms oversimplifies what is needed in any country. Even transforming countries need to strengthen foundational skills, and emerging countries need to strengthen their provision of more advanced skills. But skill development is a cumulative process: it is hard to develop technical and high-order cognitive skills without basic literacy or a strong foundation of socioemotional skills. Similarly, foundational and more complex cognitive and socioemotional skills

Figure 5.8 Education that upgrades skills also facilitates higher adoption of digital technologies



Sources: WDR 2016 team, based on World Development Indicators (World Bank, various years) and the World Economic Forum Competitiveness Index (WEF, various dates). Data at http://bit.do/WDR2016-Fig5_8.

Note: The quality-adjusted years of education are constructed by multiplying the average years of education for each country by the normalized WEF's quality of education indicator; for more details, see Monroy-Taborda, Moreno, and Santos, forthcoming. The Digital Adoption Index (People) is the simple average of two normalized indicators from the Gallup World Poll: mobile access at home and internet access at home.

built early in life and throughout general education are the base for the building and updating of technical skills in postsecondary education and training.

Priorities for emerging countries: Build foundational cognitive and socioemotional skills and ensure basic ICT literacy

The analog agenda for building foundational skills starts early, as early as 0–3 years of age, and goes beyond investment in education to that in health.[16] These are the years when children become school-ready, their brains are the most sensitive to learning, and the basis for future learning is laid. Families, individuals, school and training systems, and employers will all play a role in building these skills throughout the life cycle. It is also important to build these skills before specializing too narrowly. Countries like Poland have delayed tracking of students into vocational education, with positive results.[17]

Digital technologies can help build these foundational skills. While there are concerns about the impact of digital technologies on cognitive capacities and socialization, especially among young children, these technologies are here to stay (box 5.3). "Before a child even starts primary school, she will be able to use her parents' smartphone to learn her numbers and letters, giving her a big head start," the Gates Foundation notes.[18] Online educational games for young children, with appropriate adult supervision, are increasingly used to develop foundational skills. ScratchJr, for example, is an application aimed at teaching algorithm thinking and coding principles to kids aged 5–7 years through a simple drag and drop interface.

Access to the internet, laptops, tablets, mobile phones, digital whiteboards, and video-based instruction are increasingly common in primary and secondary education. Programs like One Laptop per Child (OLPC) are operating around the world (box 5.4). In most cases, however, there is no solid evidence base of their effects on learning outcomes, and much more careful evaluation of ICT initiatives in education is needed. But five uses of technology in building foundational skills are promising: connecting teachers to content; making learning more personalized; reinforcing content learned in school; fostering collaboration and increasing students' engagement; and promoting adult literacy (table 5.2).

Digital technologies can complement teachers and connect them to content. The BridgeIT model, started in 2004 and now used in around 10 countries, allows teachers using mobile phones to download video content, which is then connected to televisions in their classrooms. The videos are paired with learner-centered lesson plans, accompanied by teacher training in how to use the technology and incorporate it in the class.[19] A separate initiative, the Bridge International Academies, goes even further. The largest chain of preprimary and primary schools in the world, with more than 110,000 students in Kenya and Uganda, it uses technology and data analysis to standardize and scale education delivery. While the standardization of teaching remains controversial and is being rigorously evaluated, it is an alternative way to make basic education more affordable. The average family of a student in the Bridge Academy lives on US$1.60 a day per person.[20]

Digital technologies can offer access to high-quality material where there are no teachers with the needed skills. In Uruguay, through video, English is taught to first graders by teachers from the Philippines. A pilot study found that videoconferencing and laptops raised the children's scores in English significantly, as well as the English-language proficiency of the Uruguayan teachers.[21]

Box 5.3 The impact of digital technologies on cognitive capacities and socialization

There are concerns about the impact of digital technologies on cognitive capacities and socialization, especially among young children and adolescents, and some evidence backs these concerns. For example, studies show that using search engines decreases our memory. When faced with difficult questions, people are primed to turn to their computers, and, when people expect to have future access to information, they have lower rates of recall of the information and enhanced recall of where to access it.[a] There are also concerns about internet addiction. A survey of nearly 12,000 adolescents in 11 European countries found a 4.4 percent prevalence of pathological internet use. An additional 14 percent had a milder addiction. People who exhibited problematic use were more likely to suffer from psychological problems, such as depression or anxiety.[b]

Yet the fear that new technologies lessen our ability to function is nothing new; in Plato's dialogue, The Phaedrus, Socrates worried that writing would diminish the ability to engage in conversation. Parents and schools can do things to lessen these risks. Strengthening self-regulation in young children can mediate potentially negative effects of internet use.[c] While it is true that using technology to do things for us that we no longer are doing for ourselves means that certain abilities can degenerate, it also means that we are freeing up cognitive energy for other things. More research on the impact of digital technologies on cognitive abilities, and how they can be managed, is an important agenda for the future.

a. Sparrow, Liu, and Wegner 2011.
b. Durkee and others 2012.
c. Spada 2014.

Box 5.4 One Laptop per Child: Strengthening analog foundations and careful evaluation

Of all the educational initiatives that involve digital technologies, the One Laptop per Child (OLPC) program (or more generally, 1 to 1 computing initiatives) is arguably the most ambitious. Its main objective—empowering children by providing them with digital devices at an affordable price—has captured the attention of world leaders, media, and academia.[a] Since the first laptop distribution started in Uruguay in 2007, OLPC programs have distributed more than 2.4 million laptops around the globe.[b] In Uruguay, the program was widely supported by children, parents, and school directors, providing internet access to many low-income children.[c]

Although all OLPC programs increased access to digital technologies, their implementation and impacts on learning outcomes vary greatly. In a meta-analysis of 15 studies of OLPC programs in five countries (China, Colombia, Ecuador, India, and Peru), only the programs that accompanied the distribution of laptops with some level of guidance, from providing training courses to using adaptive software for weekly sessions, improved learning. These guided-use programs had a positive, albeit small, impact of 0.17 standard deviations on average scores, against an insignificant effect for programs where use was not guided.[d]

The success of digital devices in the classroom in improving academic performance hinges on complementing access to digital technologies with investments in teachers, and on embedding the technology with relevant content that can be integrated with traditional classroom activities. More careful evaluations of pilot programs before they go to scale are also important to better understand whether the programs can produce positive results and are cost-effective, as well as the specific changes needed to improve their effectiveness.

a. Trucano 2012.
b. http://one.laptop.org/map.
c. Martinez, Alonso, and Diaz 2009.
d. Arias Ortiz and Cristia 2014.

Table 5.2 Emerging countries: A skill development agenda for a modern labor market

Priority	Pillars of an analog policy agenda	How digital technologies can complement
Foundational cognitive and socioemotional skills	• Early childhood development and school readiness	• Complementing teachers and expanding access to quality material (BridgeIT in the Philippines and Tanzania; Khan Academy) • Making learning more personalized through adaptive curricula and assessments
Digital literacy	• Mainstream of socioemotional skills and basic digital literacy in teaching methods and assessments • Adult literacy	• Reinforcing content learned in school, to consult with teachers or learn new material (Eneza, Kenya) • Facilitating learning and collaboration and increasing students' engagement (Educopedia in Brazil, game-based learning or online games) • Promoting adult literacy (using SMS in Niger and Los Angeles), in combination with e-entrepreneurship

Source: WDR 2016 team.

Note: SMS = short message service.

Digital tools also make it easier to tailor learning to each student and rapidly assess student progress. Impact evaluations suggest that the successful applications of technology help introduce an appropriate curriculum or enable students to move through material at their own pace.[22] Khan Academy is a good example (box 5.5). These types of tools can be particularly helpful in developing countries, where students often need to develop skills that their teachers lack or do not teach.[23]

Digital technologies can reinforce learning. In Mumbai and Vadodara in India, a math reinforcement program, delivered through computer games, had large positive effects on children's academic achievement.[24] Children were offered two hours of shared computer time per week, during which they played games that involved solving math problems. The program increased math scores by 0.35 standard deviations the first year, and 0.47 the second year. Similar uses of technology to reinforce learning are being applied around the world, often using simple mobile phones. Eneza Education, in Kenya, is a virtual tutor that provides practice questions and answers open questions via SMS (short message service) from students on low-cost mobile phones. It has 39,000 active users, and more than 380,000 people have used it at least once.

A fourth promising technology is facilitating collaboration among teachers and students and making learning more fun and effective through games and game-based learning. More often than not, students are not engaged in school. In more than 15,000 classrooms in seven Latin American countries, between one-fifth and one-quarter of total class time, a large group of students (six or more in classrooms with average size of 25) is visibly not engaged in the classroom. This is partly because most classes are boring: for about one-third of all time spent on teaching activities, teachers use the blackboard and nothing else.[25] Using digital technologies for collaboration (box 5.6) or for game-based learning could improve engagement and learning. At its simplest, textbook material could be made more engaging: eLimu, which has embedded the primary education curricula of Kenya in tablets, enriched the content with videos and other animations.

Yet introducing technology alone, without improved teacher training and links to changes in pedagogy, will not improve the learning process. Digital technologies are most likely to have an impact when the focus is not on hardware and software but on how they contribute to learning.[26] In Colombia, Computers for Education had little effect on student test scores and other outcomes. Although students in the program schools were 30 percentage points more likely to report using a computer at school, they used it only for computer science.[27] Similarly, in Ireland, teachers were positive about the usefulness of ICT in secondary schools, yet most uses were outside the classroom for preparing lessons, rather than exploiting the potential of ICT to introduce innovative teaching and learning practices.[28] As with One Laptop per Child (see box 5.4), annual evaluations of Text2teach, the local version of BridgeIT, in the Philippines have

Box 5.5 Khan Academy: A supplemental educational resource in and outside the classroom

Khan Academy is an online learning platform that provides free tutorial videos on disciplines ranging from elementary mathematics to computer programming. It attracts more than 10 million unique users a month (35 percent from outside the United States), who have viewed 365 million videos and solved more than 1.8 billion math problems.[a] It is an example of tools for the "flipped classroom," in which videos substitute for classroom instruction, and class hours are used for practice and discussion.

Khan Academy is built on free lecture videos, adaptive learning practice problems, and personalized data. Lectures are divided by subject, but users can select what to focus on, advance at their own pace, and receive instant feedback. Following the video lectures, students can practice, and the system adjusts the difficulty of practice problems based on a student's performance on the first few problems. Students' online performance is recorded, and students, teachers, and parents can follow progress through the personalized learning dashboards.

While Khan Academy is still used predominantly by individuals for informal study outside schools, its use in schools and other institutional settings is growing. There is not enough evidence to claim that it has been an unqualified success, but the evidence points to its considerable potential. SRI International studied the implementation of Khan Academy in nine schools in the United States from 2011 to 2013.[b] Khan Academy mainly supplemented teachers' own core instruction rather than replacing it. Forms of use varied: additional practice or remediation for students who fell behind, enrichment activities for advanced students, and monitoring student progress. Khan Academy increased engagement of students and the capacity of teachers to support their students, but teachers found it difficult to fully integrate it with the core curriculum.

A pilot in five schools in Chile had similar results.[c] Khan Academy improved student math skills, but was not "flipping the classroom." Moreover, the teachers believe that while Khan Academy improved the procedural skills, it was not best for promoting deeper mathematics learning.

Integrating tools like Khan Academy into education systems shares some of the challenges that other technologies in education face. Translation and adaptation to local contexts is costly. Khan Academy is partnering with other organizations in several countries to do this. And streaming videos requires high-speed connectivity, which is still limited in many developing countries. Since the success of the program is a function of teacher skills and engagement, school and government administrations should support teachers throughout the period of implementation.[d]

a. Murphy and others 2014.
b. Murphy and others 2014.
c. Light and Pierson 2014.
d. Trucano 2015.

identified the need to invest even more in teacher training for further improvement.[29]

Even when used, technology does not substitute for teachers. High-quality education continues to hinge on high-quality and motivated teachers. In India, the computer-assisted learning (CAL) program for math had very different impacts depending on how it was used. When the program supplemented regular classes with one additional hour of CAL instruction every day after school, it raised math scores by 0.28 standard deviation. But when it was a substitute for regular instruction, scores fell by 0.57 standard deviation.[30]

Governments can play an important role in building complementary investments to leverage educational technology. This is primarily about preparing and training teachers in the use of the technology and in how to incorporate it in the classroom. Training programs in developing countries often focus only on basic computer literacy. In Singapore, by contrast, both pre-service and in-service teacher training curricula integrate pedagogy and ICT.[31] With these investments, technologies can amplify teacher productivity and improve the quality of teaching. In systematic reviews of education interventions, technology-assisted learning, together with teacher training programs, have among the largest positive effects on learning outcomes.[32]

Outside formal education, digital technologies can also boost adult literacy. In Afghanistan, Chad, and Mali, more than 60 percent of adults remain illiterate; in Niger, close to 85 percent.[33] Digital technologies,

Box 5.6 Using digital technologies to foster collaboration and learning: Rio de Janeiro's Educopedia

In 2010, the Rio de Janeiro municipality launched Educopedia, a collaborative online platform of lessons open to students and teachers from public schools. By offering stimulating multimedia resources in the classroom, Educopedia's goals are to support teachers in creating and sharing teaching materials online and to increase students' motivation to learn. The lessons online cover math, Portuguese, science, history, geography, English, music, and physical education, organized by grade and week of the curriculum.

The modules generally blend videos and interactive exercises for students with a clear structure and repeated reinforcement questions. Each Educopedia module consists of a lesson plan to help teachers structure the class; supporting content such as PowerPoint presentations on new material and texts, videos, and games; and interactive resources such as a chat system, a digital library, quizzes, summaries, and sets of test questions. The materials are projected on digital whiteboards.

When the program was piloted, teacher take-up was low. The secretariat responded by asking the network of teachers that produces and assesses the adequacy and quality of online materials to reach out to colleague teachers and provide hands-on support in using the new resources. In 2010, Rio municipality teachers used information and communication technology (ICT) only 1 percent of the time in the classroom; a year later, use had quadrupled.

Today, Educopedia operates in all 700 Rio de Janeiro municipal schools and serves 680,000 students; 50 percent of teachers report that they use the tool more than once a week. The impact of Educopedia on student learning has not been evaluated yet, but the secretariat believes its effects on the motivation of both teachers and students are positive. Educopedia was one of the pillars of education reforms in Rio de Janeiro, which between 2009 and 2012 saw a 22 percent increase in its score in the Basic Education Development Index for middle schools. In a recent survey, 80 percent of Rio de Janeiro municipal students agreed that Educopedia contributes to their learning, particularly through the interactive exercises and educational games.

Sources: Bruns and Luque 2014; WDR 2016 team.

especially mobile phones, can promote basic numeracy and literacy for these adults. In Niger, including instruction on using simple mobile phones with voice and SMS capacity in a basic adult education curriculum substantially improved learning outcomes.[34] Similar programs in advanced settings, like Los Angeles, have had similar effects, with technology actually improving literacy without the need for teachers.[35] In only four months, basic reading scores went up about five years, and more advanced reading scores, about two and a half years.

Digital literacy is a new foundational skill

In a world where digital technologies are at the center of people's personal and professional lives, digital literacy—just like reading and writing—is a new foundational skill. Among children and youth, just giving access to these technologies can be enough for them to learn the basic use of devices. The evidence from One Laptop per Child (see box 5.4) and from Hole-in-the-Wall in India indicates as much.[36] The main challenge is to broaden the digital literacy agenda beyond the basic use of devices to focus more on information skills, including the ability of students to search for information and separate high-quality sources from low-quality ones. International experience offers some important lessons (box 5.7).

In many developing countries, the greater challenge is to reach adults, often in low-literacy environments. Lack of awareness of the potential usefulness of digital technologies remains an obstacle to adoption.[37] In some cases, digital technologies, especially mobile phones, are adapted for the illiterate or those with little education through the use of graphics, symbols, and audio or video tutorials. In addition to technical training, which can be costly and which many adults would not use, countries can raise awareness and demonstrate some of the potential benefits of digital technologies—as in Turkey, where a mobile unit goes to lagging regions and shows how to use government services online.

Among youth and adults, digital literacy training can be combined with e-entrepreneurship training and seed funding to conduct business over the internet. Two areas of focus could be e-commerce and online work. For e-commerce, the focus could be on how to

Box 5.7 Emerging lessons from digital literacy programs

Digital literacy programs considered most successful have some principles in common:

- They are mainstreamed into the non-ICT (information and communication technology) curriculum. They emphasize ICT as a tool rather than a subject. Students learn how to use digital technologies not in specialized and isolated labs but as part of their learning other subjects. Finland has gone for mainstreaming, which makes the digital skills learned more useful in real life, but requires training for all teachers. Training also aims at using internet search effectively and safely, and understanding privacy rules.
- They focus on teachers' digital literacy. Evaluations of Khan Academy, the rollout in schools of broadband in Ireland, eLimu and Eneza in Kenya, and the One Laptop per Child programs in Latin America show that a lack of digital literacy or fear of using new methods is a constraint for teachers. As a result, programs are increasingly being combined with intense teacher training. eLimu—which has embedded the Kenya primary education curricula in tablets and enriched the content with animations to make learning more engaging—had to extend teacher training from 15 minutes to a full day.
- They go beyond ICT, into the beginnings of "computational thinking." Such thinking refers to the problem-solving skills and techniques software engineers use to write programs, especially those related to breaking a problem into parts, pattern recognition, abstraction, and algorithm design.[a]
- They are embedded in local content (chapter 4). This can motivate learners by connecting them to information on issues relevant to them but also by reducing language barriers.

a. ISTE and CSTA 2011.

market yourself and be able to sell online. Countries could explore partnerships with e-commerce platforms. Alibaba, for example, offers training on how to sell on its platform, and has signed agreements with governments (such as the Republic of Korea) to do so. For online work, the training could focus on introducing participants to online work, setting up their profiles, and establishing payment accounts. Nigeria is starting to provide this type of training.[38]

Priorities for transitioning countries: Build new economy skills for careers, not just for the first job

Improving advanced cognitive and socioemotional skills requires rethinking curricula and teaching methods

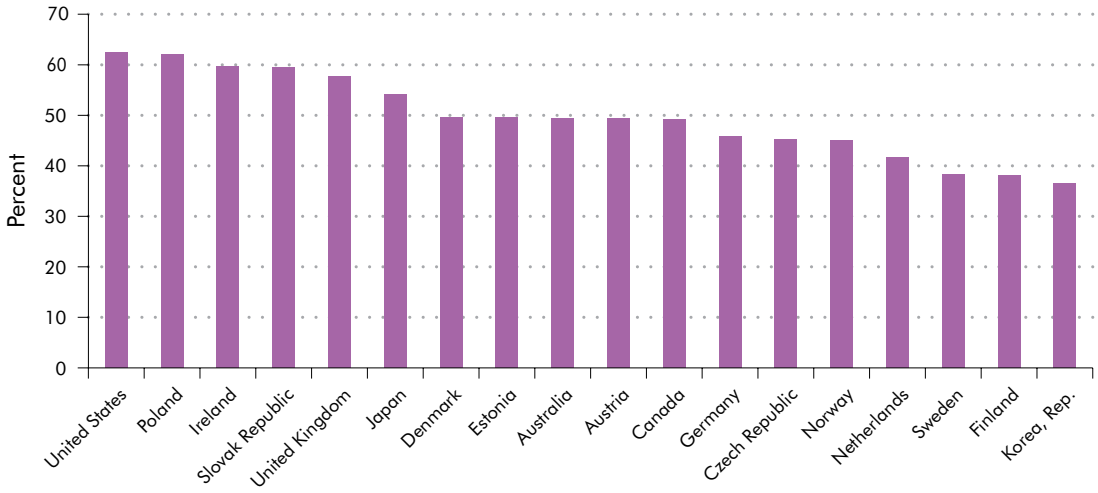
In addition to foundational skills, workers are being required to use more critical thinking and problem solving, communication, teamwork, and creativity. These are general skills, which many traditional education systems fail to impart, and can be applied across occupations and jobs (figure 5.9 and table 5.3). How can teachers, administrators, and policy makers create an environment that goes beyond rote learning and memorization, and where students really learn—where they think critically about information—and apply it to the world around them in meaningful ways?

A first step is to modernize general education curricula and teaching methods, shifting toward student-centered curricula that emphasize new economy skills. Which qualities school systems need in order to develop these skills is debated, but there is agreement that it needs to start early. One model is Montessori schools. Teachers trained in a Montessori perspective emphasize, from early childhood onward, attention to the individual interests of students. Classrooms are less hierarchical. Students have substantial unstructured time to collaborate around shared interests and freedom to research a topic of interest and present it to the class.[39] While rigorous evidence on this is limited, students in five Montessori middle schools in the United States were more intrinsically motivated and interested in their academic activities at school.[40] Similarly, the Perry Preschool Program in the United States teaches kids reading and math, but also to plan tasks, execute their plans, and review their work in groups. Although based on a small sample, the program has been found to boost socioemotional skills and to determine life outcomes of former students well into their 40s.[41]

Modern curricula should balance competency-based and content-based learning, and be combined

Figure 5.9 Even in advanced countries, youth are often unable to think critically and solve problems

Share of youth (aged 16–24) scoring below 2 in the Programme for the International Assessment of Adult Competencies in problem solving in technology-rich environments



Source: Davalos and Santos, forthcoming, based on the OECD Programme for the International Assessment of Adult Competencies (PIAAC) website, http://www.oecd.org/site/piaac. Data at http://bit.do/WDR2016-Fig5_9.

with teaching methods that stimulate and build in critical thinking, problem solving, communication, teamwork, and creativity. The New School model in Colombia (Escuela Nueva, in Spanish) has taken this approach, putting stronger emphasis on group learning and problem solving than on memorization and copying. This model has informed the modernization of the curriculum in many countries: so far, it has been piloted or has been already extended to around 17 countries (box 5.8).[42]

Countries like Brazil, Finland, the Republic of Korea, the former Yugoslav Republic of Macedonia, Mexico, Peru, Singapore, and Vietnam are taking actions to foster new economy skills.[43] Despite being a top performer in international student assessments, Finland recently concluded a large reform of its preprimary and basic education curricula. The aims are to develop schools as learning communities and to emphasize the joy of learning and a collaborative atmosphere, as well as promoting student autonomy in studying and in school life. In particular, there will be much focus on general transversal competencies and work across school subjects. The competencies will also be assessed as a part of subject assessment. The emphasis set on collaborative classroom practices will be brought about in multidisciplinary, phenomenon- and project-based studies where several teachers may work with any given number of students simultaneously.[44]

Table 5.3 Transitioning countries: A skill development agenda for a modern labor market

Priority	Pillars of an analog policy agenda	How digital technologies can complement
Higher-order cognitive and socioemotional skills	• Modern curriculum, teaching methods, and assessments with increased emphasis on critical thinking, problem solving, and socioemotional skills (Escuela Nueva model; Republic of Korea; Singapore) • Modernize teacher training in-service and pre-service accordingly	• Directly promoting critical thinking, teamwork, problem solving, and creativity (through online games, wikis, hackathons) • Delivery of training in socioemotional skills (grit and mind-set interventions) • Promoting collaboration (virtual exchanges)

Source: WDR 2016 team.

Box 5.8 Building new economy skills: Escuela Nueva in Colombia and Vietnam

The Escuela Nueva model started in Colombia in 1976 as an innovation in multigrade teaching, promoting active, participatory, and cooperative learning among primary school students. Today it serves 5 million students in 16 countries, including Brazil, the Dominican Republic, Mexico, the Philippines, Uganda, and Vietnam.

The model is based on several innovations for improving teamwork and developing critical thinking. The curriculum is focused on a self-paced and self-directed learning guide. Group learning is facilitated through the use of learning guides that contain interactive exercises. Teachers are trained in group management. Group learning is also fostered by class arrangements and a modified role of teachers as facilitators. Students are seated in clusters of four or five, with teachers guiding, supervising, and evaluating the children in these groups. The school calendar and evaluations are flexible, so that children can meet learning goals at their own pace.

Evaluations of the model in Colombia and elsewhere indicate that the program is fostering both cognitive and socioemotional skills. The model improves levels of Spanish and math in the third and fifth grades, as well as self-esteem and the abilities to lead others in group tasks and to work peacefully with others in a team. A recent impact evaluation of Escuela Nueva's first two years in Vietnam shows that the model helps children learn to work with each other and develop communication and interpersonal skills. Improved cooperative learning skills also enable a student to obtain better results in math.

Sources: WDR 2016 team based on Bodewig and others 2014; Colombia Aprende 2015; Forero-Pineda, Escobar-Rodriguez, and Molina 2006; Fundación Escuela Nueva 2015.

Singapore has also made large changes to its education system to adapt to the knowledge-based economy. The main change was in 1997, with a move from an efficiency-driven model to an ability-driven model.[45] The efficiency-driven model, an engineer's vision to education, had a top-down approach in designing, disseminating, and enforcing the national curriculum; streaming students by competency levels to ensure that teachers were dealing with students of similar levels; and creating clear but rigid paths to vocational and tertiary education. While this model produced students who scored high on international math and science tests, it produced students who were not critical thinkers and teachers who were not motivated.[46] Under the new ability-driven model, schools have more autonomy over their curriculum and develop programs to suit their students. More emphasis is placed on project work, introduced from primary education onward, with a move from high-stakes examinations to smaller assessments. The government has also emphasized the use of ICT in the curriculum.

Whether to streamline teaching new economy skills into the traditional curricula, as in Finland or Peru, or whether to teach them in targeted classes or interventions, as with grit (that is, perseverance in pursuing long-term goals) in FYR Macedonia, is an open debate. Even if taught separately, it is important to reinforce learning these modern skills across subjects. A teacher could give a lecture on history with little class interaction, or could break the class into small groups that would reflect on the reading material, prepare takeaways, and present to the whole class, thus teaching history as well as teamwork, empathy, communication skills, problem solving, self-regulation, and self-esteem.[47] Changes can also include introducing more open-ended questions in home assignments and in tests, more flexible classroom seating arrangements that allow work in groups, having discussions involving the full classroom, and creating spaces in classrooms and schools for collaborative projects. The increased demands on teachers need to be accompanied by modernizing teacher training, both in- and pre-service. Teacher training needs to focus on how to teach curriculum content and on how to impart socioemotional skills.

Countries are making progress in improving student assessments, critical for identifying strengths and weaknesses in the education system, designing policy, and strengthening accountability. Yet current assessments typically focus on testing information, facts, or the ability to read or perform math operations. While important foundational skills, these skills are often fairly routine and easily programmable, so

student assessments can be further strengthened by broadening their scope to better incorporate higher-order skills.

Open-ended questions in tests can put greater emphasis on critical thinking and problem solving. New economy skills can be monitored, as is traditional academic learning, through mechanisms such as the KIPP Report card, where socioemotional skills are identified, measured, and discussed with parents and students at evaluation time.[48] At the international level, the Organisation for Economic Co-operation and Development (OECD) and the World Bank have recently implemented new skill measurement assessments that aim at measuring, among adults, problem solving in technological environments, and socioemotional skills, respectively.[49] L'Oréal, the French cosmetics company, asks job candidates in China to answer three open-ended questions on mobile phones, and then uses "big data" and an algorithm to mine the responses for cues on critical thinking and socioemotional skills.[50]

Digital technologies can also foster higher-order cognitive and socioemotional skills—in at least three ways:

- *Directly promoting critical thinking, teamwork, problem solving, and creativity.* This could be done through digital activities, such as programming. Scratch, a simple programming language for kids, can help develop abstract and critical thinking from an early age. Digital tools, such as wikis—online content-management systems that allow for collaborative modification, extension, or deletion of its content and structure—can promote discussion and communication inside and outside the classroom. Many schools are now using hackathons, events where teams collaboratively work on software projects, and which can provide a creative space that also fosters problem solving. Incorporating learning games into classrooms (game-based learning) and applying the principles of gaming to education (gamification) could also foster higher-order cognitive and socioemotional skills, such as abstraction, reasoning, and teamwork, while bringing the power of play to education and engaging, inspiring, and immersing students in learning (box 5.9).
- *Developing and delivering training in socioemotional skills.* Grit (that is, perseverance in pursuing long-term goals) and growth mind-set lessons,[51] for example, can be delivered via videos and over the internet. Additional online modules that target other socioemotional skills could be part of teachers' toolkits.
- *Supporting teamwork and communication skills by bringing together diverse teams and breaking the distance barrier.* The World Links for Development Program has worked with ministries of education in more than 20 middle- and low-income countries to link classrooms to the internet but also to one another. European Schoolnet has fostered long-term online connections among classrooms across borders.[52] Social media can also be used to connect classrooms.

Priorities for transforming countries: Focus on advanced technical skills and lifelong learning

ICT skills and training in computational thinking

As in other countries, the skills agenda for transforming countries needs to also strengthen foundational skills, and develop new economy skills, such as higher-order cognitive and socioemotional skills. Because the skill base in transforming countries is stronger than in the emerging and transitioning countries, they also have to focus on more advanced technical skills (table 5.4).

To address shortages in advanced ICT skills and improve competitiveness in a growing industry, countries are paying more attention to providing advanced ICT skills training in their education system. Many firms report difficulties in finding workers with advanced ICT skills (chapter 2). Partly in response, coding, as a subject, has been introduced in the general education curriculum in Estonia and the United Kingdom.

Incorporating advanced ICT skills in the general curriculum can teach computational thinking in transforming countries. But not everyone needs to become a professional coder. Incorporating coding in general education can strengthen not only ICT skills but also critical thinking, especially if it is a vehicle to teach logic and learning strategies for solving problems, designing projects, and communicating ideas. Done well, it can be not only about "learning to code" but about "coding to learn."[53]

Training in advanced ICT skills can also be provided less systematically, and outside of the formal education system. This could be the route for countries with less mature education systems. For example, advanced ICT skills could be offered in middle or high schools through accredited massive open online courses (MOOCs). Individuals can also learn coding through specialized online platforms. Codecademy, an online interactive platform that offers free coding classes in seven programming languages, has more than 24 million users who have completed over 100 million exercises.[54]

Box 5.9 Building modern skills: Game-based learning and "gamifying" education

Learning can be fun. Play can be a great conduit for learning and creativity because it taps into people's intrinsic motivation, satisfying needs of autonomy, competence, and relatedness. When playing, many people achieve a state of "flow"—a state of concentration that activates the brain and is considered optimal for new learning.[a] Applying the principles of gaming—rules, goal achievement, progressive difficulty, interaction and student control, uncertain outcomes, and immediate feedback—to classroom activities can teach both cognitive and socioemotional skills. Some games apply these principles to teach basic skills, such as math and vocabulary in games like King of Math and FunEnglish, while others integrate learning into the game. Dragonbox, Freddi Fish, and Guild Wars require creative thinking, problem solving, and building on existing knowledge to succeed.[b] Requiring inference and problem solving, rather than direct questioning for learning, they are more engaging and can lead to sustained learning.[c]

Games can not only increase engagement but also improve learning outcomes. A unique English program in India can be implemented with different technologies (a specially designed machine or games and activities based on special flash cards). New methods yielded gains of about 0.3 standard deviation in test scores.[d] A 2006 study of fifth graders found that playing math games was more effective than basic math drills at building math skills, as measured by performance on a standardized math exam.[e] And two science games, RiverCity, which emphasizes ecology and biology, and Supercharged!, a program on electrostatics, improved learning outcomes over a traditional lecture by 15 to 18 percent and 8 percent, respectively.[f]

But most of today's teachers are not equipped with the skills to make games effective learning tools, such as designing materials and environments for game-based learning, partly because they are not familiar with many tools of the digital age.[g] Teachers need to be trained so that they understand both the potential and the limits of games for learning and fully understand the game, how to play, and how to use it as a teaching tool. Teachers can work with parents in finding appropriate games and defining parameters for usage. Updated curricula, reformed assessments, and resources for learning games can all help to shift classrooms to be focused on learning. Policy makers could also encourage more research and development to create successful learning games that are engaging, thoughtful, and immersing, and facilitate efficient learning.

The future of games and game-based learning extends beyond the classroom. Evoke, developed by the World Bank, uses social media tools and narrative approaches commonly found in video games to empower young people to start solving urgent social, real-world problems. Food Force, created by the United Nations, teaches strategy and networking by simulating aid agencies working in food insecurity. The Facebook game Half the Sky highlights gender equality and raises money for female empowerment. Games can also be tools for job training, especially when real on-the-job training is dangerous; the U.S. military has used video games to teach strategy, skills such as first aid, and military rules and ethics.[h]

a. Jarvilehto 2014.
b. Becker 2007; Prensky 2006; Jarvilehto 2014.
c. McFarlane, Sparrowhawk, and Heald 2002.
d. He and others 2007.
e. Grabowski and Fengfeng 2007.
f. Mayo 2009.
g. Prensky 2006; Becker 2007; Jarvilehto 2014.
h. Prensky 2007.

Countries with a local technology industry or where online work is common, already teach advanced ICT skills outside the education system. In Kenya, NairoBits equips youth with knowledge in web design, IT skills, creative multimedia, and entrepreneurship. This technical training is combined with training in socioemotional skills to build self-confidence. NairoBits-trained youth have secured employment in both formal and informal sectors and report a job placement rate of 90 percent.[55] Similarly, iHub, one of the innovation and hacker spaces in Kenya, holds hacker labs for children and youth aged 10 to 16.

Many developing countries are partnering with the private sector to develop technical training in advanced ICT skills after general education. Mexico First, a partnership with Cisco and Microsoft, targets professionals and university students to facilitate training and certification in ICT.

Table 5.4 Transforming countries: A skill development agenda for a modern labor market

Priority	Pillars of an analog policy agenda	How digital technologies can complement
Advanced ICT skills and STEM in general education and beyond	• Strengthen collaboration between the private sector, governments, and educational institutions (Mexico First) • Promote STEM education	• Coding for kids (Scratch) • Coding among adults and outside the educational systems (NairoBits, Kenya; Codecademy) • Enhancing practical training (virtual labs and online work)
Lifelong learning	• Promote practical training in education • Provide incentives for firms to provide on-the-job training	• Increasing flexibility and reach for adult learning (MOOCs)

Source: WDR 2016 team.

Note: ICT = information and communication technology; MOOCs = massive open online courses; STEM = science, technology, engineering, and mathematics.

Strengthening education in science, technology, engineering, and mathematics (STEM)

Improving STEM education has become a major goal not only in transforming countries but also in most other countries. But good intentions are not always paired with concrete and effective actions. Addressing shortages and deficiencies in the teaching of STEM requires preparing and equipping teachers properly and including STEM across the educational system—not just in tertiary education. It also requires creatively involving the employers, more effectively connecting the teaching and research activities, and establishing financial incentives or compensatory mechanisms to make STEM education viable and affordable to underrepresented groups. And it requires enabling institutions and governments to share experiences and lessons in addressing the STEM education deficits. The World Bank–funded Partnership for Skills in Applied Sciences, Engineering and Technology brings together the expertise in several Sub-Saharan countries with that in Brazil, China, India, and the Republic of Korea.

Women are much less likely than men to choose a STEM field in tertiary education, in both advanced and developing countries, and this is partly reflected in occupational choices. In the United States, although women fill close to half of all jobs nationwide, they hold fewer than 25 percent of STEM jobs, and for every dollar a man earns in STEM, a woman earns 86 cents.[56] Women with a STEM degree are more likely to work in education or health care.

The gender gap in STEM fields starts early, both in the education system and at home. In OECD economies, at age 15, fewer than 5 percent of girls consider careers in engineering and technology, compared with 18 percent of boys.[57] Addressing gender stereotypes in school and at home can encourage girls to believe that they have the required ability for STEM and that significant opportunities will emerge for them. Other actions include providing girls with relevant role models; targeting girls for recruitment into the STEM fields early in their education, as Finland does; clearly establishing targets and incentives for recruitment, retention, and graduation of women in STEM fields; and working with employers to make work settings gender-friendly.

Promoting lifelong learning in rapidly aging societies

In rapidly changing labor markets, the skills learned in formal education risk becoming obsolete. Continued (re)training and upskilling can help workers stay current, and ensure that their skills are complementary to new technological developments.

A first part of a lifelong learning agenda is ensuring that the skills students learn are useful for entering the labor market and provide a strong base for continuing to learn on the job. Given the pace at which digital technologies are changing and how they are changing the labor market, students and adults must learn how to learn.

Governments can:

- *Provide students with practical training and exposure to the world of work prior to their graduation.* In addition to traditional apprenticeships, technology can be useful. Virtual labs and simulation games for science education and machine operations are spreading and moving ever closer to the brick-and-mortar experience.[58] Online work can also expose young students and trainees to the world of work.

- *Explore modular approaches to learning* so that students can move between education and work, as in Denmark or in College to Careers in the United States in postsecondary education. In the latter, students complete modules with clear accreditation and competencies acquired (often equivalent to "expertise" levels), which allow them to monetize the newly acquired skills in the labor market, even before completing the full degree. Students can then return to the community college and continue to the next level of expertise. Nanodegrees or microdegrees, offered by MOOC platforms Udacity and Coursera in partnership with the private sector, take the modular approach to online-based education.
- *Strengthen links between the private sector and higher education and vocational systems.* Ensuring that graduates from the education system acquire job-relevant cognitive, socioemotional, and technical skills requires that firms, universities, and vocational schools, and current and future students, become better connected. The German dual system is a very formal and institutionalized way of fostering these links, but there are other approaches. Chicago's reforms of the city's community colleges targeted curricula more explicitly to sectors with a large presence in the region, including manufacturing and insurance. Specific components of these curricula were discussed with major employers in these sectors to ensure relevance for the job market.[59]
- *Focus publicly financed training on new economy skills and ICT skills.* New economy skills are likely to be underprovided by firms because the benefits do not accrue solely to the firm.[60] Several youth employment programs, such as Jovenes in Latin America, combine technical training with socioemotional skills for disadvantaged groups, and many have had an impact on employment and earnings.[61]

Vocational training institutes in developing countries are starting to use the internet to deliver at least parts of their courses. The Dominican Republic training institute offers a wide range of online courses, including teacher training and inventory management, and reports particular interest from youth and individuals who are already working or who have family responsibilities.[62] MOOCs can also be a tool for lifelong learning (box 5.10).

- *Promote on-the-job training.* Traditional market failures limit on-the-job training[63] so one common mechanism for promoting on-the-job training is to have institutional arrangements between employers and employees. "Payback clauses" commit the worker to stay at the firm for a specific amount of time if training is provided. In apprenticeships, the worker shares the costs of training through lower wages. The German apprenticeship system is a well-defined program that relies on a dual system of classroom training in vocational institutions and training at the workplace.

A second common mechanism for on-the-job training relies on financial arrangements that internalize some of the externalities related to employer-provided training. In developing countries, this typically takes the form of training funds, usually through payroll taxes, as in Brazil, Chile, Malaysia, and Mexico. Other schemes compensate firms for the cost of training through levy exemptions, tax rebates, and cost reimbursements. But as with other subsidies, these can be inefficient and crowd out private expenditures on training. It is, therefore, important to target the subsidies carefully, trying to go beyond firm size, as in Malaysia's Human Resources Development Fund.[64] In OECD countries, different cofinancing savings and loan schemes match individual contributions to contributions from employers and governments. Individual learning accounts, learning vouchers, and income-contingent repayment loans are just some of the possible instruments that could be used.[65]

Box 5.10 Massive open online courses (MOOCs): A promising tool for lifelong learning

MOOCs are a recent development in distance learning, characterized by three key aspects: open enrollment, online assessment, and an interactive forum. They separate themselves from traditional distance learning tools by providing postsecondary education in large scale. They are mostly free, with fees for getting certifications. Some popular courses' enrollment reach over 100,000 students. Platforms such as Coursera.org, Udacity.com, and edX.org host these online courses, facilitate online discussions, and assess participants' performances. In the first two years

(Box continues next page)

Box 5.10 Massive open online courses (MOOCs): A promising tool for lifelong learning *(continued)*

following its introduction in summer 2012, open courses offered by HarvardX and MITx, and hosted by edX, attracted an average of 1,300 new participants per course per day.[a]

MOOCs are promising. People from anywhere around the world can access postsecondary education from prestigious institutions with only a gadget and access to the internet. Among adults who work and who have a certain level of skills, online education can be a powerful force for lifelong learning. These are individuals who would appreciate the flexibility (since they can combine it with work, which is one of the usual barriers for retraining). These are also workers who are likely to be best prepared for self-guided learning. In addition, the courses provide access to specialized topics that may not be available in the local economy. At the very least, MOOCs can complement offline learning.

Coursera and edX have started to evaluate their programs. One study finds that a slight majority of MOOC students are seeking certification, and those opting for fee-based, ID-verified certificates have higher rates of completion. The study also finds that literacy and motivation to self-study are necessary characteristics to access and complete MOOCs, but so are more basic elements such as high-speed internet and digital skills.

Yet, while their potential is large, there are questions about financial sustainability, the value of online education, and the evaluation methods. Another study argues that MOOCs are an improvement on noninteractive, online courses, but that the current model is unsustainable. Eventually, content will no longer be free, and star instructors will have to be paid like stars. And although they can be an efficient way for transferring content and reinforcing learning, especially in basic courses, the lack of face-to-face interactions, the absence of individualized feedback from faculty, and the lack of access to complex infrastructure such as labs, make MOOCs an unlikely competitor to existing postsecondary education institutions, especially in the developed world.[b] Finally, in terms of evaluation, MOOCs are complementing multiple-choice and short-answer questions with peer-grading and peer-commenting systems, in which students help each other with assignments and comment on each other's work.

a. Ho and others 2015.
b. Hoxby 2014.

Institutions: Connecting for a capable and accountable government

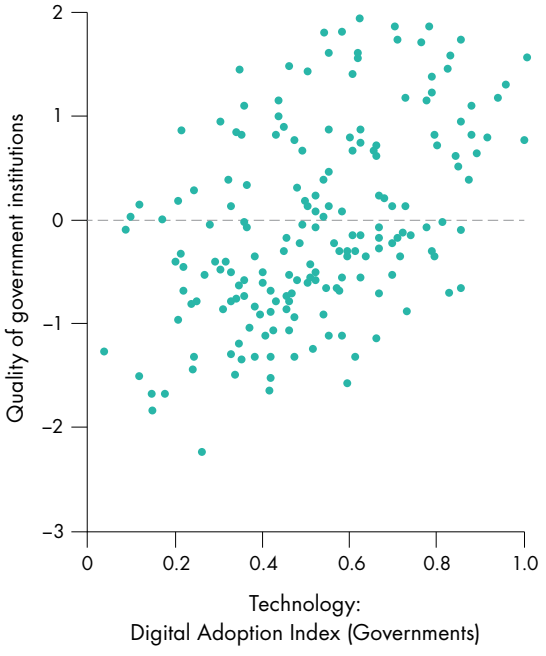
Digital technologies have had limited impact on strengthening government capability and accountability because of the misaligned incentives of policy makers and service providers—a gap between institutions and technology. They have helped willing and able governments serve their citizens better, but they have not yet empowered citizens to make unwilling governments more accountable. The policy agenda is thus to use digital technologies to strengthen institutions by tailoring policies that are compatible with the incentives of politicians and providers. The policy choices for different country contexts are informed by the findings in chapter 3 that for some services, digital technologies can substitute for weak institutions and be transformative—while for other services, digital technologies are only complementary and require strong institutions to have an impact.

Technology mixes appropriate to institutions

The policy agenda needs to be guided by the country context, classified here as emerging, transitioning, or transforming depending on the extent to which government uses digital technology and the quality of political and administrative institutions (figure 5.10).

Emerging countries are characterized by weak institutions and, in fragile contexts, the institutions may be failing. Politicians are often kept in power by a narrow set of elites who are largely unaccountable to the poor. The bureaucracy is largely patronage-based, with little incentive to deliver services. These reform contexts are the most difficult, as the state is failing not only to deliver services but also to perform the most basic functions of maintaining security. The priority in these countries is to lay the institutional foundations so that governments can start performing basic functions. They should ensure that teachers and doctors show up to work and are paid on time. They should curtail the outright theft of public funds

Figure 5.10 Countries with more accountable governments also adopt more digital technologies



Sources: World Governance Indicators (World Bank, various years) and WDR 2016 team. Data at http://bit.do/WDR2016-Fig5_10.

Note: The Digital Adoption Index (Governments) is the simple average of three normalized subindexes: core administrative systems, online public services, and digital identification. Data for online public services are provided by the UN's Online Service Index. Data for core administrative systems and digital identification were compiled by the World Bank for this Report.

through transparency and accountability measures. And they should strengthen alternative channels of service delivery through nonstate providers. The focus, from the perspective of this Report, should be in areas where digital technologies can be effective substitutes for these weak initial institutional conditions. Around 15 to 20 countries fall into this category, among them such fragile and conflict-affected states as Afghanistan, the Democratic Republic of Congo, Haiti, Somalia, the Republic of Yemen, and Zimbabwe.

Transitioning countries have mixed institutions characterized by pockets of pro-poor politicians and performance-oriented agencies. The priority for these countries should be to take advantage of this institutional heterogeneity and to use digital technologies to strengthen government capability in the "islands of excellence" that exist, and through demonstration, scale them up. The emphasis should also be on targeted transparency initiatives, those likely to be relevant to the daily lives of citizens and able to mobilize a broad coalition of supporters among businesses and other elites to align their incentives with those of willing politicians. Most developing countries fall into this category.

In transforming contexts, governments are generally accountable and capable, internet access is close to universal, many services are online, and many back-office systems are automated. One big challenge in taking e-government to the next level is the relatively low use of online services by citizens, especially poor households. Within-government collaboration across ministerial lines is weak, pushing up the transaction costs for citizens to interact with government. Another challenge is that government-citizen collaboration in policy making and service delivery is limited. Policies should focus on deepening collaborative institutions, both within government, through whole-of-government service delivery—and between government and citizens, through participatory approaches, while instituting digital safeguards to protect privacy.

Digital technologies can help in implementing policies more effectively. The key is to align the choice of digital technologies with their availability, skill requirements, and political incentives (table 5.5). While the focus here is on what to do, aligning

Table 5.5 A framework for policies: How to improve services in different contexts

Emerging countries: Laying the foundations for institutions	Transitioning countries: Building capable and accountable institutions	Transforming countries: Deepening collaborative institutions
• Improve informational services to citizens • Strengthen provider monitoring and payment • Establish population registers • Scale up nonstate provision of services • Increase electoral accountability	• Strengthen government delivery systems • Strengthen provider management • Get regular user feedback on service quality • Increase transparency in priority areas	• Improve collaboration across government • Enhance participatory policy making

Source: WDR 2016 team.

policies to institutions should also guide what not to do. For example, the misalignment of policies and political and administrative incentives is one of the most common reasons for failed ICT interventions in government. As chapter 3 showed, many low-income countries have overinvested in low-impact administrative systems, resulting in fiscal waste. So, to use the popular metaphor, investing in "toilets, not the internet" may indeed be advisable. Similarly, political elites will have little interest in collaborative service delivery or citizen engagement in clientelist systems, suggesting that an across-the-board push for open data in emerging contexts is unlikely to be successful.

Emerging countries: Laying the foundations for institutions

Given the persistent failure of many governments to deliver adequate services, the priority in emerging contexts is to use digital technologies to begin building the foundations of government institutions and, where possible, to support alternative institutional channels for delivering services. The digital solutions should be relatively simple and low cost and should not require significant business process reengineering in government bureaucracies or interagency collaboration. Where possible, they should substitute for inefficient government institutions. And to be incentive compatible, they should deliver immediate and visible benefits for politicians without threatening the elites who keep them in power. Examples of appropriate technologies and complements appear in table 5.6.

Although institutions are failing, mobile phones are ubiquitous, and many poor people in even the poorest countries have a cellphone. This almost universal access opens many possibilities for mobile-phone applications to improve services and outcomes, substituting for ineffective institutions in some services and functions. However, what poor people lack is an official identity, which excludes them from accessing many services, both public and private. So, a priority should be to build digital civil-identity systems to establish citizenship and become a platform for nonstate provision of services.

Table 5.6 Emerging countries: An agenda for laying institutional foundations and improving services

Technology	Complements
• Mobile phone–based informational services • Mobile phone–based monitoring and management • Digital population registers • Digital election monitoring	• Civil society and community involvement • Traditional media • Rewards and not sanctions

Source: WDR 2016 team.

The underlying policies can be grouped in five categories: improving informational services; strengthening the monitoring and management of service providers and facilities; developing robust digital population registers for citizen identity; strengthening nonstate provision of services through for-profit and not-for-profit providers; and improving electoral accountability through better monitoring.

Improve informational services to citizens

Mobile phones are delivering information to poor citizens in a variety of low-income countries with positive outcomes, and health applications are among the most promising uses of digital technology (see sector focus 3). In Malawi, governments and nongovernmental organizations send daily reminders to HIV-positive patients on their treatment schedule. In the Democratic Republic of Congo, health call centers enable mothers to get answers to questions about their children's health. And in Benin, Uganda, and Zambia, mobile apps raise health awareness and monitor disease outbreaks.[66] Mobile phones have also improved communication between governments and citizens for natural disasters and relief efforts—and promoted literacy through daily text message stories and teaching tips for teachers, with promising initial results (see sector focus 2).

Strengthen the monitoring and management of service providers and facilities

Ghana, Niger, Pakistan, and Uganda have demonstrated the efficacy of mobile phones as a cost-effective monitoring technology to address absenteeism among teachers and health workers. In principle, similar monitoring approaches can be applied to address missing textbooks, drug stock-outs, and petty corruption. Scaling up from pilots to national programs will, however, face bureaucratic resistance—to be mitigated by focusing on rewards instead of sanctions, such as financial incentives and recognition in the local community. A basic reward—or right—is getting regularly paid for work, a problem in many low-income countries due to inefficient budget execution. In Haiti, three-quarters of school teachers surveyed had gone unpaid for months at a time.[67] Mobile payment platforms provide a low-cost solution, as in the Bridge International Academies in Kenya. If linked to digital population registers, they can also

identify ghost workers, as in Nigeria, where a digital identification scheme for civil servants removed about 60,000 fictitious workers from the government payroll, saving US$1 billion annually.[68]

Establish population registers

Digital population registers can establish citizen identity and be leveraged later for a variety of applications through appropriate credential verification (see spotlight 4). The focus should be on developing the identity database and on the systems to ensure completeness and high quality. Only after the country has developed harmonized identity registers can it legitimately begin to tie e-services and issue the right credentials to support them. In many cases, countries, under vendor pressure, have prematurely procured costly smart cards, which then remained unused as the identity registers had not been developed first. India focused on enrollment and unique identity and launched the program without any smart cards or credentials, just an Aadhaar number communicated to individuals. Now, more than five years later, different programs are issuing application-specific credentials linked to the Aadhaar framework and database.

Scale up nonstate provision of services

Citizens in many low-income countries send their children to nonstate schools (for-profit or not-for-profit) and seek care from private health providers. Nonstate provision raises questions of equity and quality. These risks can be mitigated through regulations, disclosures, and public-private partnerships, such as voucher programs and contracting out. These programs, if implemented well, can be highly effective. In an educational scheme for marginal communities in rural Pakistan, the government paid the private provider a per-child subsidy, increasing primary school enrollments and boosting test scores by 30 percentage points.[69] These programs can also be compatible with the interests of even clientelist politicians, as they are likely to be supported by important stakeholders like the business community and private service providers.

Nonstate provision theoretically relies on the power of the market to solve accountability failures in ways that public provision cannot. But in practice, parents may lack the choice of alternative providers or the information on provider quality to "vote with their feet" and hold nonstate providers accountable. The impact of low-cost private schools on student learning is generally positive, but in some cases they can be even worse than their public counterparts.[70] Performance agreements between governments and nonstate providers require some contracting and monitoring capacity in government, and the collection and verification of data to hold nonstate providers accountable.

Digital technologies can improve the impact of these schemes through better data collection, monitoring, and dissemination of information on provider quality. Parents can make more informed decisions, fixing the market failures in private provision. Non-digital school report cards in Pakistan's rural Punjab for example, improved parental information, lowered private school prices, and boosted school quality.[71] Digital technologies can make these choices easier through simpler versions of the school and health care provider rating systems that are now commonplace in the high-income countries. And governments, in the absence of parental choice, can better hold the private providers to account.

Improve electoral accountability

Digital technologies are improving both the sanctity of elections and providing citizens with meaningful and actionable information on government performance. Although the number of electoral democracies in poor countries has increased over the past two decades, the integrity of elections in these new democracies is low. Over half of the elections over the past decade had irregularities either in the run-up to the election or on election day.[72] Elections are well-suited for digitally enabled monitoring. As high-profile events that attract significant international attention and scrutiny, improving electoral integrity may be possible even in politically difficult emerging country contexts.

Digital technologies can reduce election violence, as in Kenya and Mozambique, and uncover fraud in vote-counting, as in Afghanistan. Digital identification is being increasingly used to register voters. In Pakistan for example, ahead of the 2013 parliamentary elections, the digital identity database was used to clean the electoral rolls, leading to the removal of 37 million voters with either no, invalid, or duplicate identities, and the addition of 36 million new voters, mostly young and poor, who had valid identification.[73] Similarly, in the 2015 presidential election in Nigeria, biometric identification was used for the first time to enroll 68 million voters and to eliminate 4 million duplicate identities (see spotlight 4). Despite these successes though, biometric identification is not without its risks in emerging countries. Simpler, lower-cost monitoring technologies like cellphones that require fewer institutional complements may be preferable.[74]

Digital technologies can also improve electoral accountability by exposing corruption and abuse of office, thereby better enabling voters to sanction

lawbreaking politicians. Municipal audits in Brazil and Mexico show that targeted digital transparency initiatives can provide salient and credible information on corruption and on the quality of candidates that is easy to understand and attribute to individual politicians. Widely disseminated before an election, such information can influence voters' decisions. But such initiatives are contingent on a supportive legal framework—such as right to information laws or disclosures of conflicts of interest and assets—or on independent supreme audit institutions that may be absent in these country settings. Civil society advocacy, in partnership with traditional media, is necessary to uncover abuse and to make this information available and understandable to voters.

Transitioning countries: Building capable and accountable institutions

By introducing an automated complaint management system we took a noose and put it around our own necks. We are now accountable!

—A manager of the Nairobi water utility

Countries transitioning digitally have invested in the automation of core government administration, such as digital identification, financial and sector-specific management information systems, and on government-to-citizen and government-to-business services. They can increase the impact of these investments through complementary policies and strengthen performance orientation in bureaucracies.

Strengthen government delivery systems

These countries should continue to expand e-government, particularly digital identification systems and the business and citizen-facing services like online registration of businesses, e-filing of taxes, e-procurement, and citizen service centers. But these investments should be conditional on enacting the complementary reforms of regulatory changes, improving interdepartmental and interagency cooperation, and streamlining procedures. Digital technologies can strengthen project management through better monitoring of the different stages of the project cycle. By making procurement and contract monitoring more transparent, they can also give agencies flexibility in negotiating contracts with vendors, relaxing the procurement rigidities that cause many ICT projects to fail (box 5.11). Examples of appropriate technologies and complements appear in table 5.7.

Institutionalize user feedback on service quality

Incorporating citizen feedback into policy maker-to-provider management routines can be a powerful mechanism for tackling petty corruption and improving services, as in the Dominican Republic, Kenya, Nigeria, and Pakistan (chapter 3). It works especially well for private goods and services that are easy to

Box 5.11 Increasing the impact of e-government systems

Better project management: The U.S. Office of Management and Budget in 2009 introduced the IT [Information Technology] Dashboard, a public website that provides detailed performance information on major IT investments by the federal government. That information is then used to review problem projects at monthly TechStat meetings between the federal Chief Information Officer and the respective agencies. The Government Accountability Office found that these reforms improved the transparency and oversight of government IT spending.

Flexible and transparent IT procurement: E-government projects often fail because of rigid procurement rules. But making procurement transparent can ensure that discretion is not abused. The European Union allows agencies to negotiate with multiple bidders and award the contract to the vendor with the best revised bid. The greater discretion would not be possible without the greater monitoring, accountability, and trust afforded through the e-procurement system.

Public-private partnerships: A number of middle-income countries have implemented e-government projects through public-private partnerships, minimizing the risks of failure associated with misaligned incentives and limited government capacity. Such partnerships are feasible for revenue-raising services, for managing citizen service centers, as in Brazil and India, and for government e-procurement systems, as in the Indian state of Karnataka.

Sources: U.S. GAO 2014; Kenny 2014; Krishna 2015, for the WDR 2016.

Table 5.7 Transitioning countries: An agenda for building capable and accountable institutions and improving services

Technology	Complements
• Digital ID, G2G, G2C, and G2B e-government and e-procurement systems • Digital performance management • Targeted digital transparency initiatives • Digital platforms for citizen feedback and participation	• Streamlining of procedures • Improved interdepartmental cooperation • Regulatory reforms • Public-private partnerships for fee-based services

Source: WDR 2016 team.

Note: G2B = government-to-business; G2C = government-to-citizen; G2G = government-to-government.

monitor, like drivers' licenses, property transfer and registration, and water and electricity connections, since users have both the incentive and the ability to provide feedback. Politicians are likely to support it because it yields immediate and visible service improvements without threatening elites and vested interests. Similar approaches can monitor service providers, facilities, assets, and public spending.

Digital platforms can also raise resources from citizens to fund infrastructure, hire contract teachers, and purchase drugs and educational materials, and digital monitoring technologies can assure citizens that their contributions are going to their chosen causes. GiveDirectly, a Silicon Valley–based philanthropy, enables well-off individuals all over the world to contribute funds directly to poor beneficiaries in developing countries. The private sector has also been much more successful in getting citizens to create internet content for public causes. Wikipedia, Yelp, Trip Advisor, and Amazon product reviews provide lessons for solving collective action problems and engaging citizens in public service delivery improvements.

Strengthen provider management through regular small-stakes monitoring

Most services and functions in government—teaching, curative health, policy making, and management—require considerable discretion from workers and produce outputs and outcomes that are difficult to monitor. Improving these services requires strong institutions. Digital technologies can only augment and not substitute for institutions. Even though measuring performance is difficult for these services and functions, the processes of setting goals, of regularly communicating and discussing them with staff, and of associating small rewards, such as public recognition, for teams and individuals in the achievement of even imprecisely measured goals can motivate workers to perform better (box 5.12). A survey of government workers in the Philippines found that a performance incentive scheme triggered improvements in management practices through goal setting and improved teamwork.[75] And a mobile phone–enabled

Box 5.12 Regular, small-stakes monitoring

Regular monitoring with small rewards or sanctions can be more effective than irregular monitoring with large rewards or sanctions. The logic of this proposition is motivated by the economic theory of crime that postulates that the incentives for criminals to commit a crime are a function of the probability (P) of getting caught multiplied by the severity of the punishment (C). While standard economic analysis presumes that what matters is only the product P x C, the evidence suggests that raising the severity of punishment in response to low probabilities of catching criminals is not credible because many law enforcement officials are loathe to impose draconian punishments for smaller offenses. For example, in Hawaii, revoking probation when probationers failed a drug test was for years an ineffective strategy, given the large numbers of violators and the impracticality of sending them to prison for several years. But raising P and lowering C—regular, randomized drug tests and jail sentences of two days—deterred parole violations because the punishment strategy became more credible.

These findings are generally applicable to other services. Digital technologies reduce the cost of monitoring and thus make it more feasible to give regular rewards and sanctions. If the rewards and sanctions are small, they can be feasibly imposed, improving performance.

Source: Romer 2013.

monitoring scheme increased the motivation of rural teachers in part by showing that officials in the faraway ministry of education cared about their work and were looking out for them.[76]

Digital technologies can improve goal setting and within-government communication between policy makers, managers, and providers. Many private organizations are introducing short "pulse" staff surveys to get rapid responses from employees on particular issues, to gauge employee motivation, and to motivate workers through "employee of the month" public recognition schemes, and "gamification" techniques like assigning points, leaderboards, badges, and other small rewards for the achievement of particular activities.[77] The ubiquity of mobile phones makes such within-government feedback channels quite feasible even in low-income countries, and can certainly be applied in the pockets of excellence in transitioning contexts. While the measurement of performance and the feedback is subjective and imprecise, it is the regular communication and monitoring tied to the small-stakes rewards that improve worker motivation.

Reinforce targeted transparency initiatives

Digital technologies can provide a new lease on life for transparency initiatives such as the Open Government Partnership, an international platform for committed domestic reformers. But the initiatives should be targeted and of value to citizens and of interest to the private sector and other important stakeholders. Consider the transparency of government contracting. Governments annually spend over US$9 trillion on procurement, at high risk of corruption, both in bidding and during contract execution.[78] E-procurement is technically easy to implement, yet, as described in chapter 3, developing countries have invested less in such systems than in the more complex budget and treasury systems—or have done so without the complementary reforms to deliver results. E-procurement also has the potential to galvanize substantial support from the business community by reducing barriers to entry—since it expands the market to new entrants, including international firms—and by opening political space for reform.

Digital technologies can also expand the range of actors that generate information, breaking the state's monopoly in information provision. Because such information can be skewed toward the digitally savvy, it should be used where representativeness is not a requirement and the risks of manipulation are small, as with real-time information on emergencies or on the quality of services that are easy to monitor, like electricity and water.

Transforming countries: Deepening collaborative institutions

Many transforming countries have improved service delivery, but only in some areas. Their services are not yet sufficiently integrated, holding them back from more ambitious interventions such as greater government-citizen collaboration in policy making and service delivery.

Increase citizen use of government services through integrated whole-of-government digital solutions

The gap between the provision of e-services and their use is wide—even in digitally advanced countries—and it is not closing. In Australia, Canada, and New Zealand, a majority of survey respondents prefer traditional channels like phones for routine transactions such as paying taxes or registering children for day care.[79] This low use reveals the waste in e-government investments. Part of the explanation lies in less friendly experiences. Federal government websites in the United States provide a poorer user experience than comparable private ones.[80] Of more than 400 applications that the Korean government offers over smartphones, none meet the criteria of a seamless, cross-agency, or cross-functional one-stop service.[81]

Increasing use will require better integration of e-government across government, which requires breaking down agency silos and improving data sharing across government. In the private sector, digitally enabled improvements in customer service, a core differentiator in the service industry, are conditional on high levels of shared knowledge in the firm.[82] Estonia's X-Road data-sharing protocol shows how data integration can work within the constraints of the ministry and agency structure of government (box 5.13). Data integration is also essential for effective open data platforms that the private sector can use to develop applications that citizens want. Examples of appropriate technologies and complements appear in table 5.8.

Expand participatory policy making and service delivery

Increasing use of digital technologies is also conditional on a better understanding of citizens' needs and thus on simplification and customization. Behavioral research has shown that individuals are "cognitive

Box 5.13 Estonia's X-Road

Estonia's X-Road is an internet-based e-government system that enables participating institutions, including private business, to communicate and exchange data.[a] It serves as a platform for application development by providing numerous common services to users, including query design, query tracking, and data visualization. Its open design is protected by digital authentication, multilevel authorization, log monitoring, and encrypted data transfers. This collective process improves the user experience and motivates state institutions to develop digital services and people to tap into digital government services. The common goal is to shift activities from the physical world to the much more efficient digital realm.

X-Road's utility is evident in its exponential growth. The system launched in 2003 with 10 participating institutions. By 2013, almost 900 had joined—70 percent are national or local government agencies, and the remainder private firms. The annual number of queries through X-Road rose from half a million to 340 million. In 2014, two-thirds of queries were automated system-to-system exchanges. The remaining one-third, about 113 million human queries, reflects enormous demand for e-services from a population of only 1.3 million.

The system's main strength is that it is decentralized. Participating institutions retain ownership of their data, but can share it or access other institutions' data as necessary. Estonia's Public Information Act prohibits institutions from requesting user information already stored in a data repository connected to the X-Road.[b] Thus the system's architecture—coupled with complementary policies—has reduced the need for repetitive data entry, increased government efficiency, and reduced costs to users. If e-services are assumed to yield 30 minutes in time saved per interaction (for the service provider and the citizen) relative to predigital physical interaction, the number of applications in 2014 implies a savings of more than 7 million work days a year—5.4 work days for each citizen.

Source: Vassil 2015, for the WDR 2016.

a. See the Information System Authority's website at https://www.ria.ee/x-road/.
b. https://www.riigiteataja.ee/en/eli/522122014002/consolide.

Table 5.8 Transforming countries: An agenda for deepening collaborative institutions and improving services

Technology	Complements
• Integrated whole-of-government digital solutions	• Breaking down of silos
• Participatory policy making and service delivery	• Learning from the private sector

Source: WDR 2016 team.

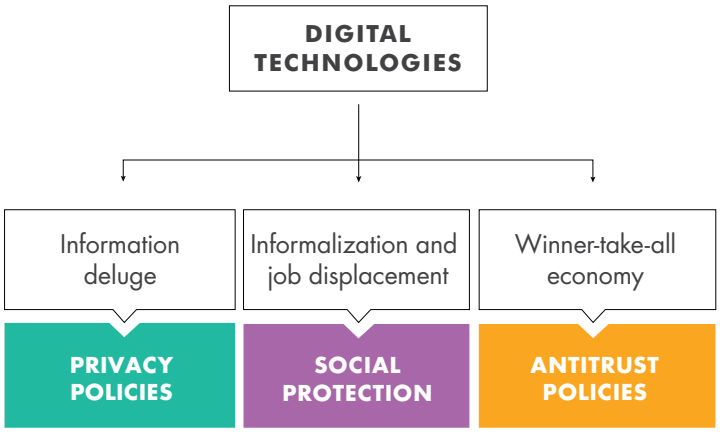
misers" who engage in motivated reasoning. Their decision making is often automatic, and they are more likely to search for and absorb information that confirms their priors rather than process new information that does not.[83] The private sector understands this and simplifies and customizes the user experience to engage customers. Amazon's search tool not only displays results the customer is looking for but also recommends other products based on the customer's browsing history and the purchasing trends of other customers. Transforming countries can learn from the private sector and embed these principles of simplification and customization in their e-services to foster greater collaboration with citizens.

Digital safeguards

Reforms to strengthen the analog complements can ensure a high social and economic return from digital investments. But downside risks remain. Large-scale collection of identifiable information creates privacy and security concerns. Automation changes work in ways that challenge existing social protections and reveal the inadequacy of existing labor laws. And scale economies create antitrust concerns. Digital safeguards that mitigate these risks become more important as the digital transformation proceeds (figure 5.11). Competition and cybersafety are discussed elsewhere in this Report. This section focuses on another important safeguard for the digital economy, namely changes to social protection, taxation policy, and labor market institutions.

Digital technologies are accelerating job creation and job destruction, requiring a more flexible

Figure 5.11 Digital safeguards in the WDR's framework



Source: WDR 2016 team.

workforce that responds to changing labor market demands. They are also facilitating new forms of nonwage employment and work arrangements which, while adding flexibility to firms and workers, can also erode traditional employer-employee relationships (chapter 2). This transformation of the world of work requires a rethink of social protection, tax systems, and labor market institutions. In incipient and transitioning countries, this agenda is less urgent, but it will be important to build systems appropriate for the 21st century and not to blindly adopt models designed by advanced countries for an industrial era.

Support technology adoption and level the playing field between workers and technology

Labor regulations, labor taxation and institutions need to support, rather than impede, technology adoption by firms. They should also avoid making labor unduly expensive, especially for workers who compete more directly with digital technologies. Technology, by accelerating the pace of change in the labor market, can make existing labor regulations obsolete and delay firms' adjustments.[84] And tight labor regulations often apply to low-skilled workers,[85] increasing the incentives for firms to substitute low-skilled workers with labor-saving technology, accentuating the skill-bias of technological change. This appears to be the case globally.[86]

Countries with unduly protective labor markets could be slowing their digital transformation, and distorting firms' decisions to automate work. This is likely to affect countries that have particularly stringent hiring and firing practices.[87] There are also implications for minimum wages, especially their growth path, if workers who earn close to the minimum wage are also in routine occupations susceptible to automation. Tax systems that rely heavily on taxing labor also make labor more expensive in relation to capital and could become unsustainable if wage employment falls. In-work benefits, such as income tax credits in the United States and the United Kingdom, are one mechanism for policy makers to make labor taxes more progressive while improving incentives to work and hire.[88]

Digital technologies themselves can reduce nonwage labor costs related to enforcement. In Brazil, the Annual Social Information report (digital records from social security with information about all workers, their wages, their occupations, and the types of firms they work for) monitors compliance with the Apprentice Law and, increasingly, other labor laws.[89] Oman has a Worker Protection Scheme that allows for monitoring wage payments. Digital technologies can further reduce enforcement costs by shifting from top-down to bottom-up accountability, empowering workers and unions to convey complaints and violations and to resolve conflicts. In the United States, workers can anonymously file online complaints and requests for inspections of their workplace if they believe there is a serious hazard or labor law violation; they can get information about their rights.[90] They can also check online whether their employers have paid their social security contributions. These tools increasing worker agency have the potential to balance the loss of bargaining power for workers in nontraditional work arrangements, such as independent contractors in the gig economy, where many workers are freelancers or work online.

Balance the relaxation of job protections with stronger workers' protections independent of work contracts

Independent contracting, casual work, freelancing, and other new forms of work in online labor markets and the sharing economy challenge the foundations of most social protection and tax systems. In most countries, social insurance schemes—for pensions, unemployment, and health—are tied to a (formal) job, financed through payroll taxes levied in the formal sector.

The evolving nature of work increases the need to delink social insurance from the labor contract. Bolivia, Chile, and Costa Rica have been grappling with providing social insurance to noncontributing, nonwage, informal workers for a long time. Their

experiences suggest that all individuals should be registered in the same social insurance system, regardless of where they work, with subsidies for the poor or low-wage earners, and with financing coming from general revenues.[91]

The labor market disruptions that accompany technological change increase the demands on active labor market policies and social assistance systems. The disruptions are likely to be greatest for workers in routine occupations. Some of them are going to need intermediation and retraining services to find new jobs. Others, if they have difficulties transitioning, may need social assistance. Recent technological changes are bringing to the fore discussions of a guaranteed basic income, especially in more advanced countries. And giving workers a stake in digital capital could diversify workers' assets and reduce their costs of displacements—through pension funds, mutual funds, or even more directly in firms active in the digital economy.[92]

A solution is to protect workers rather than jobs, and to level the playing field for regulations and taxation across work contracts. If workers are protected outside their labor contract, regulations and taxes can be more lax across the board. A first step is to do away with regulations that almost prohibit flexible work arrangements. In Montenegro contracts for part-time employment cannot be less than 10 hours per week.[93] Another step is to reform tax systems that tax part-time work at higher per hour rates than full-time work. In Serbia, the reference wage (determining a minimum social contribution) is not adjusted for hours worked, so that social contributions are disproportionately high for part-time workers.[94] Reforms are also necessary in working time arrangements.[95]

Notes

1. See, for example, https://e-estonia.com.
2. Decker and others 2014.
3. See Atkinson and Miller 2015.
4. See OECD 2015.
5. The first stage (2000–05) of Rwanda's National Information and Communication Infrastructure policy prepared the groundwork for the ICT sector. The second phase (2006–10) concentrated on enhancing ICT infrastructure. The third phase (2011–15) focused on improving service delivery. The final phase (2016–20) is expected to concentrate on the enhancement of skills and development of the private sector and community. Instead of first dealing with the supply-side issues and then the demand-side issues, developing countries would be better off by working to simultaneously strengthen the two pillars of their digital strategy. For details, see Rwanda's ICT strategy at http://www.rdb.rw/uploads/tx_sbdownloader/NICI_III.pdf.
6. See Hanna 2015.
7. See http://www.plugintheworld.com/mobisol/.
8. Many developing countries adopt the competition frameworks of more advanced economies, but fail to implement them adequately.
9. Fines imposed by competition authorities remain symbolic in several countries. In Armenia, Kenya, and Central American countries, the current structure of fines and sanctions is not conducive to deterring anticompetitive conduct. In Armenia, maximum fines for price-fixing cartels are 1.5 percent of the average turnover of the 100 largest taxpayers, compared with a best practice of about 10 percent of a firm's turnover in other countries.
10. According to data from the market-research firm IDC.
11. Rochet and Tirole 2006.
12. World Bank 2012a; Bodewig and others 2014; World Bank 2011; Cunningham and Villasenor 2014.
13. Functional illiteracy is defined as the proportion of exam takers who score below a level 2 in the PISA reading test. WDR 2016 team, based on OECD PISA 2012 scores.
14. Guerra, Modecki, and Cunningham 2014; Shonkoff and Phillips 2000; Almlund and others 2011; Cunha, Heckman, and Schennach 2010; Cunha and Heckman 2007.
15. STEP household surveys and OECD's Programme for International Student Assessment (PISA).
16. Guerra, Modecki, and Cunningham 2014; Bodewig and others 2014.
17. Arias and others 2014; Sondergaard and others 2012.
18. Gates Foundation 2015.
19. http://www.text2teach.org.ph/?page_id=2.
20. http://www.bridgeinternationalacademies.com/company/about/.
21. http://www.britishcouncil.co/en/about/english-education-solutions/success-stories/remote-in-service-teacher-training-english.
22. Kremer and Holla 2009; and Kremer, Brannen, and Glennerster 2013.
23. Bruns and Luque 2014.
24. Banerjee and others 2007.
25. Bruns and Luque 2014.
26. Bruns and Luque 2014.
27. Barrera-Osorio and Linden 2009.
28. Devitt, Lyons, and McCoy 2014.
29. http://www.text2teach.org.ph/wp-content/uploads/2012/06/Phase3-by-third-party.pdf.
30. Linden 2008.
31. Bruns and Luque 2014.
32. McEwan 2013; Kremer, Brannen, and Glennerster 2013.
33. World Development Indicators (World Bank, various years).

34. Aker, Ksoll, and Lybbert 2012.
35. Ksoll and others 2014.
36. In a slum in New Dehli, a freely accessible computer was put up for use in a hole in a wall. With no prior experience, the children learned to use the computer on their own (see http://www.hole-in-the-wall.com/Beginnings.html).
37. Research ICT Africa surveys (various years), discussed in chapter 2.
38. Kuek and others, forthcoming.
39. King and Rogers 2014.
40. Rathunde and Csikszentmihalyi 2005.
41. Heckman and others 2010.
42. For more information on the New School model, see http://www.escuelanueva.org/portal/en/escuela-nueva-model.html.
43. In FYR Macedonia, for example, the government is starting a pilot introducing growth mind-set and grit training in primary schools; see Bodewig and others (2014) for a discussion on ongoing reforms in Vietnam.
44. Halinen 2015.
45. The "Thinking Schools, Learning Nation" concept was articulated by the Singaporean prime minister in a speech on June 2, 1997. http://www.moe.gov.sg/media/speeches/1997/020697.htm.
46. Goh and Gopinathan 2008.
47. Guerra, Modecki, and Cunningham 2014.
48. Guerra, Modecki, and Cunningham 2014.
49. See http://www.oecd.org/site/piaac/ and Pierre, Sanchez Puerta, and Valerio 2014.
50. http://www.bbc.com/news/world-asia-china-31617597.
51. See Duckworth and others 2007, for grit; and Dweck 2006, for growth mind-set.
52. Trucano 2015.
53. Resnik 2013.
54. http://www.codecademy.com/.
55. http://www.nairobits.com/.
56. Beede 2011.
57. OECD PISA 2006.
58. Waldrop 2013.
59. For more information on College to Careers, the flagship program of Chicago's reform efforts, see http://www.ccc.edu/menu/Pages/college-to-careers.aspx.
60. Almeida, Behrman, and Robalino 2012.
61. Almeida, Behrman, and Robalino 2012.
62. WDR 2016 team interview with INFOTEP (April 2015).
63. Almeida, Behrman, and Robalino 2012.
64. Almeida, Behrman, and Robalino 2012.
65. OECD 2004.
66. Aker and Mbiti 2010.
67. Adelman and others 2015.
68. Statements of then-minister of finance Dr. Ngozi Okkonjo-Iweala, as reported by the media on October 22, 2014. http://www.news24.com/Africa/News/Tanzania-orders-probe-into-ghost-government-workers-20150329.
69. Barrera-Osorio and others 2013.
70. Tooley and Longfield 2015.
71. Andrabi, Das, and Khwaja 2014.
72. Bishop and Hoeffler 2014.
73. Malik 2014.
74. Gelb and Clark 2013.
75. World Bank 2015.
76. Aker and Ksoll 2015.
77. Banuri 2015.
78. Kenny 2014.
79. Reddick and Turner 2012.
80. Morgeson and Mithas 2009.
81. Eom and Kim 2014.
82. Ray, Muhanna, and Barney 2005.
83. World Bank 2015.
84. Alesina, Battisti, and Zeira 2015.
85. World Bank 2012b; Hamermesh 2014; Kuddo 2015.
86. Alesina, Battisti, and Zeira 2015; O'Mahoney and Van Ark 2003.
87. Kuddo 2015, based on World Economic Forum's executive opinion survey on hiring and firing practices.
88. Chetty and Saez 2009; Blundell and Brewer 2000; Blundell, Duncan, and Meghir 2002; Hotz and Scholz 2001; Trampe 2007.
89. Silva, Almeida, and Strokova 2014.
90. https://www.osha.gov/as/opa/worker/complain.html.
91. Ribe, Robalino, and Walker 2010.
92. Freeman 2015.
93. Arias and others 2014.
94. Arias and others 2014.
95. Kuddo 2015.

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