CHAPTER 1.11

Maximizing the Impact of Digitization

KARIM SABBAGH
ROMAN FRIEDRICH
BAHJAT EL-DARWICHE
MILIND SINGH
SANDEEP GANEDIWALLA
Booz & Company

RAUL KATZ
Telecom Advisory Services LLC

Policymakers today face a different environment for information and communications technology (ICT) than the one for which they designed policies. ICT technologies are far more pervasive than they were previously: more people today have access to a mobile phone than to electricity, powering exponential growth in global data generation.[1] With ICT access approaching ubiquity, policymakers' next challenge is to ensure that individuals, businesses, and governments are making the best possible use of networks and applications. Countries that have achieved advanced levels of *digitization*—the mass adoption of connected digital technologies and applications by consumers, enterprises, and governments—have realized significant benefits in their economies, their societies, and the functioning of their public sectors.

Previous attempts to measure the impact of ICT have focused primarily on assessing the economic effects of widespread access to either wireless or broadband technologies. But in developing a comprehensive methodology to measure the impact of digitization, Booz & Company found greater benefits linked to growing usage of digital technologies and applications, rather than access alone. We also found that benefits are not just economic, but encompass social and political spheres as well. Digitization offers incremental economic growth: countries at the most advanced stage of digitization derive 20 percent more in economic benefits than those at the initial stage. Digitization has a proven impact on reducing unemployment, improving quality of life, and boosting citizens' access to public services. Finally, digitization allows governments to operate with greater transparency and efficiency.

Policymakers have an important role to play in ensuring that their countries are progressing toward advanced stages of digitization. They need to acknowledge where they currently stand and recognize the benefits of digitization. Finally, they need to shift focus away from access and set into motion programs and plans that focus on the widespread adoption and usage of technology. That includes elevating digitization on the national agenda, including the systematic planning and tracking of their efforts; evolving sector governance structure; adopting an ecosystem perspective; enabling competition; and stimulating demand.

DIGITIZATION: ICT'S NEXT EVOLUTION

The proliferation of digital technologies over the past two decades has been substantial, marking one of history's most rapid rates of adoption of new technologies. The number of personal computers (PCs) in use worldwide surged from 100 million in 1990 to 1.4 billion by 2010. There were 10 million mobile phone users in the world in 1990; today there are more than 5 billion.[2] The number of Internet users grew at an even more rapid rate over the same decades, from 3 million to 2 billion.[3] To put that into context, only two decades ago there were as

many Internet users in the world as people in the city of Madrid; today, there are as many people online as are living in all of Asia. The surge in ICT use has not been restricted to the developed world. In Africa, for example, more than half a billion people today connect to mobile networks.[4]

The explosive growth of ICT services is presenting policymakers with three key challenges. The first challenge is to establish standard performance indicators to measure the extent to which ICT is being assimilated in societies. During most of the sector's development, ICT stakeholders focused primarily on access, building the networks that today connect much of the planet; they devised metrics accordingly. In a world of near ubiquity in terms of access, policymakers need a new way to look at the ICT sector.

The second challenge concerns the lack of tools that can determine the impact that the mass adoption of connected digital technologies and applications is having on societies and economies. With practical, reliable tools to measure the benefits of digitization, governments could potentially be more ambitious in developing and investing in the ICT sector.

The third challenge is for policymakers to adopt new policy tools to accelerate digitization and reap its accompanying benefits. Over the past two decades, policymakers established rules to enhance access to communication services—setting policies that introduce competition and promote infrastructure sharing, for example. Now they need to gain a similar understanding of the ways in which they can encourage adoption and boost the usage of digital applications by consumers, businesses, and public institutions.

DEFINING AND MEASURING DIGITIZATION

We believe the extent of a country's digitization can be measured across six key attributes:

- Ubiquity[5]—the extent to which consumers and enterprises have universal access to digital services and applications;
- Affordability[6]—the extent to which digital services are priced in a range that makes them available to as many people as possible;
- Reliability[7]—the quality of available digital services;
- Speed[8]—the extent to which digital services can be accessed in real time;
- Usability[9]—the ease of use of digital services and the ability of local ecosystems to boost adoption of these services; and
- Skill[10]—the ability of users to incorporate digital services into their lives and businesses.

To measure digitization and chart its evolution, we created a composite score consisting of the six critical attributes and measured these with data collected across 23 indicators with the aid of proxy measures (see Figure 1).[11]

Understanding digitization: The stages

We measured digitization for a sample of 150 countries on a scale of 0 to 100, with 100 being the most advanced, and then isolated four distinct stages of digitization development: constrained, emerging, transitional, and advanced (see Figure 2). These groupings will allow policymakers to recognize their nation's current level of digitization and provide perspective on how to progress.

Constrained economies—those with a digitization score below 25—face challenges in realizing basic digitization building blocks such as widespread access and affordability. In these nations, services remain expensive and limited in reach.

Emerging economies—those with a score between 25 and 30—largely have addressed the affordability challenge and have achieved significant progress in providing affordable and widespread access. However, the reliability of services in emerging digitization nations remains below par and capacity is limited.

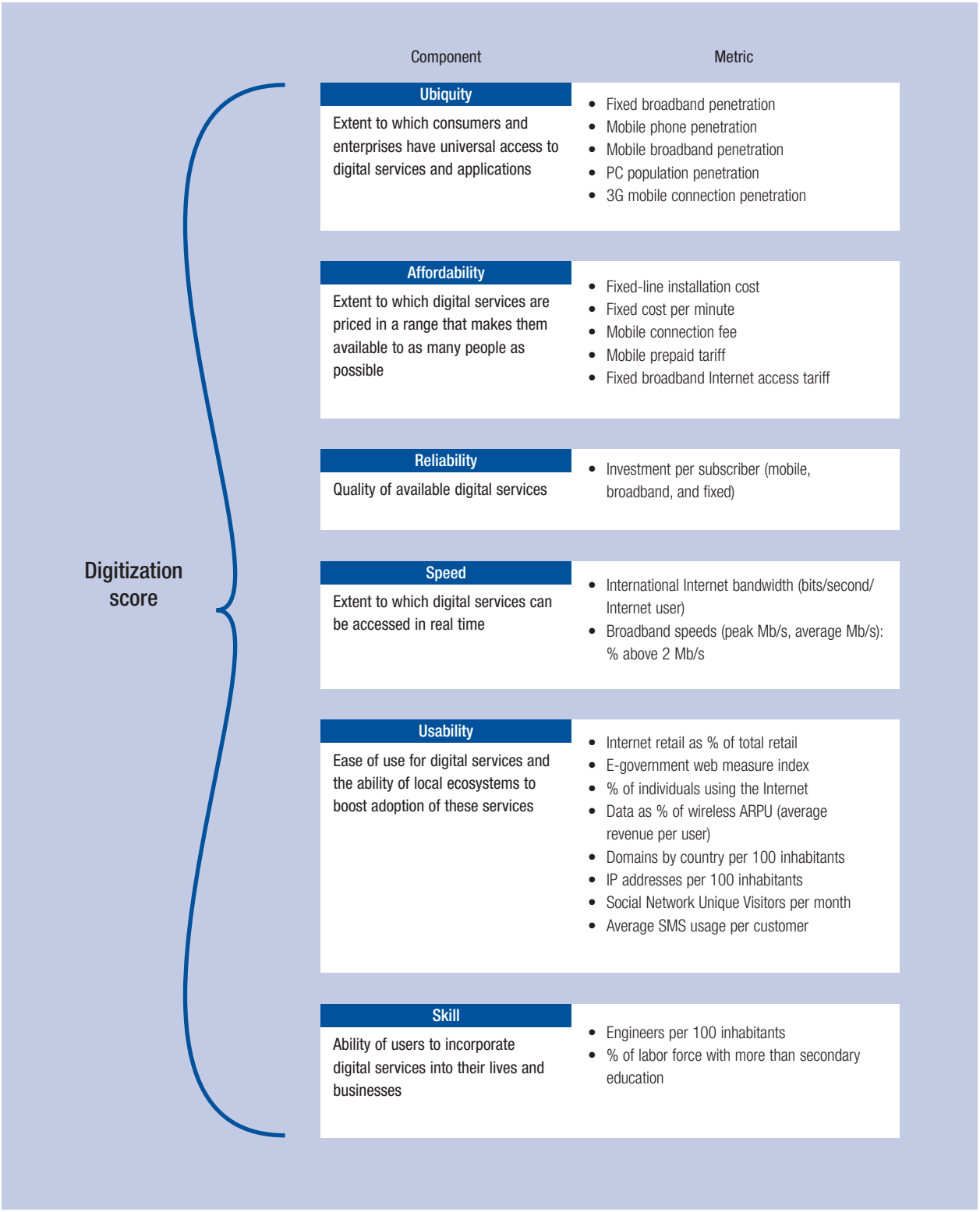
Transitional is the next digitization stage, encompassing those countries with a digitization score in the range of 30 to 40. Countries in the transitional stage have addressed the reliability challenge and provide citizens with access to ubiquitous, affordable, and reasonably reliable services. Alongside the jump in reliability, transitional countries show minor advances in the speed, usability, and skill indexes.

Advanced is the most mature stage of digitization, achieved with a score greater than 40. These countries have made significant strides in addressing ICT usability and developing a talent base to take advantage of available technologies, products, and services while improving the speed and quality of digital services.

The accelerating pace of digitization

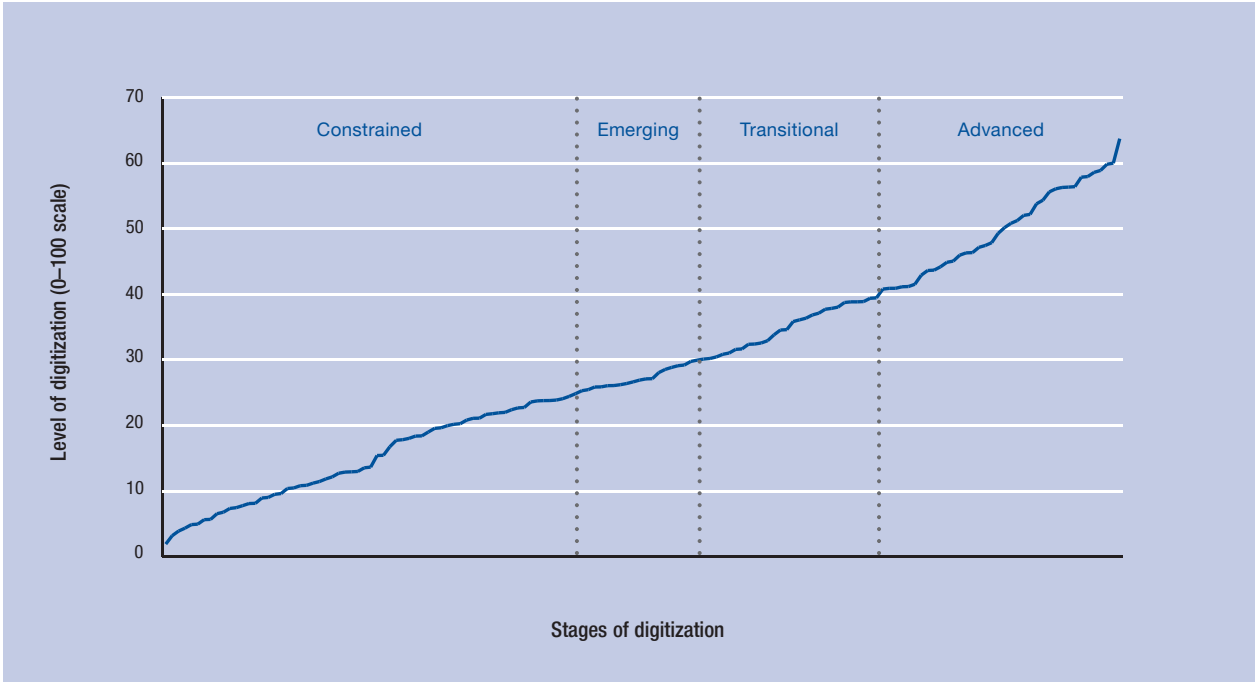
The pace of digitization and movement between stages is accelerating rapidly. Developed countries such as Germany, the United Kingdom, and the United States took nearly four years on average to move from the emerging to the transitional stage of digitization; now, developing countries such as the United Arab Emirates, Kuwait, and Estonia are making that same amount of progress in less than two years. Overall, between 2004 and 2007, countries registered 39 stage leaps; in the ensuing three-year period of 2007 to 2010, 65 countries progressed to the next level of digitization development. Not only has the pace quickened, but the jump in development has also been more marked. From 2004 to 2007, the average growth in the digitization score was seven points. From 2007 to 2010, the average jump was ten points.

Figure 1: Key components of the digitization score



Sources: Data from ITU, Ovum, Euromonitor, Akamai, ILO (Laborsta), Global Insight, UN, WCDM, Webometrics, Bgexpert, Internet World Stats, UNESCO, Wireless Intelligence, and Telecom Advisory Services; Booz & Company analysis.

Figure 2: Stages of digitization, 2010 digitization levels

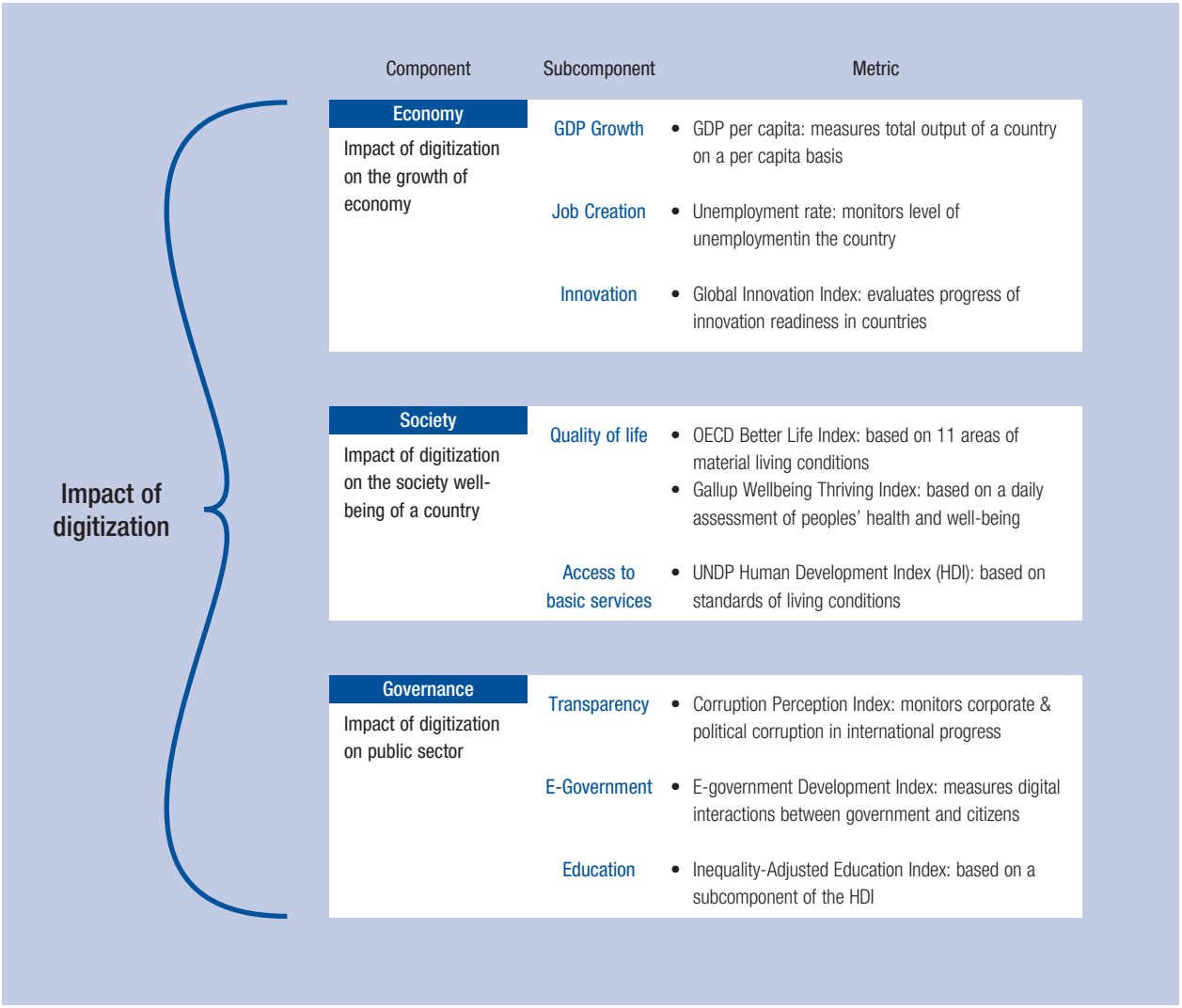


150 economies

Constrained		Emerging	Transitional	Advanced
Ethiopia	Morocco	Georgia	Jordan	Lithuania
Comoros	Honduras	Bosnia and Herzegovina	Seychelles	New Zealand
Niger	Kyrgyzstan	Ecuador	Barbados	Slovenia
Burkina Faso	Bolivia	China	Mexico	Belarus
Madagascar	Sri Lanka	Armenia	Turkey	Hungary
Afghanistan	Moldova	Trinidad and Tobago	Montenegro	Poland
Lesotho	Aruba	Botswana	Colombia	Greece
Mali	Namibia	Antigua and Barbuda	Bahrain	United Arab Emirates
Rwanda	Guatemala	Azerbaijan	Philippines	Slovak Republic
Yemen	Dominican Republic	Panama	Iran, Islamic Republic	Romania
Togo	Suriname	Venezuela	Macao SAR	Russia
Cameroon	Pakistan	Albania	Serbia	Czech Republic
Mozambique	Paraguay	Saint Lucia	Argentina	Netherlands
Sao Tome and Principe	El Salvador	Macedonia FYR	Oman	Ireland
Benin	Gabon	Peru	Uruguay	Italy
Burundi	Fiji	Brazil	Latvia	Spain
Lao PDR	Egypt	Costa Rica	Croatia	Austria
Senegal	India	Mongolia	Bulgaria	Germany
Djibouti	Belize	Lebanon	Cyprus	Portugal
Cuba	South Africa		Ukraine	France
Nepal	Guyana		Estonia	Singapore
Iraq	Kazakhstan		Kuwait	Belgium
Uganda	Algeria		Malta	Australia
Uzbekistan	Thailand		Qatar	Finland
Kenya	Tunisia		Saudi Arabia	Sweden
Vanuatu	Brunei Darussalam		Mauritius	United Kingdom
Swaziland	Indonesia		Malaysia	Japan
Côte d'Ivoire			Chile	Denmark
Vietnam				Israel
Bangladesh				Canada
Cambodia				Taiwan, China
Nigeria				Luxembourg
Zambia				United States
Ghana				Switzerland
Syria				Hong Kong SAR
Angola				Korea, Rep.
Cape Verde				Iceland
Bhutan				Norway

Sources: Data from ITU, Ovum, Euromonitor, Akamai, ILO (Laborsta), Global Insight, UN, WCDM, Webometrics, Bgexpert, Internet World Stats, UNESCO, Wireless Intelligence, and Telecom Advisory Services; Booz & Company analysis.
Note: Countries are ordered from the least to the most digitized within each stage.

Figure 3: The framework for measuring digitization's socioeconomic impact



Sources: Data from the World Bank, the World Economic Forum, INSEAD 2011, the OECD, Gallup Wellbeing Surveys, the UNDP Human Development Report, Transparency International, the UN Public Administration Network, and Telecom Advisory Services; Booz & Company analysis.

This acceleration stems from a number of factors. Emerging countries now can follow the path that developed nations have already blazed, learning from their best practices. They also can take advantage of mature technologies and markets, and the resulting price reductions. Furthermore, acceleration between stages can stem from increased liberalization and the growing affordability and availability of digital technologies and skills. This hastens the implementation and usage of new technologies and the deployment of supporting infrastructure.

In sum, the whole world is moving toward an advanced stage of digitization at a rapid clip.

ASSESSING THE IMPACT OF DIGITIZATION

After developing a methodology to determine a nation's level of digitization, the next step was to understand the contribution of digitization to economic strength, societal well-being, and effective governance (see Figure 3).

Economic impact

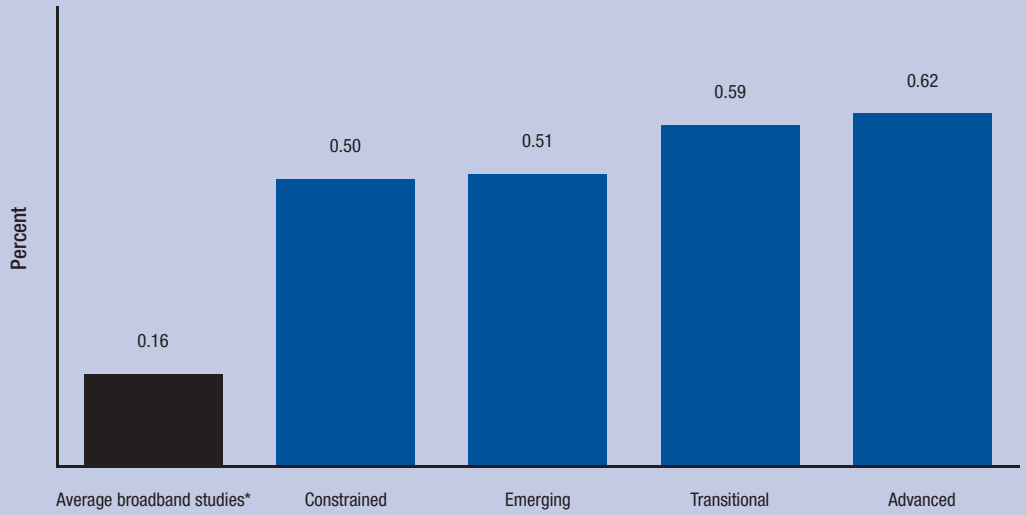
Our analysis confirms that digitization has a material economic impact, which we assessed with three variables: growth in per capita GDP, job creation, and innovation. We analyzed 150 countries using a classical production function model to assess economic impact, controlling for a number of variables.[12]

We found that an increase in digitization of 10 percentage points triggers a 0.50 to 0.62 percent gain in per capita GDP. By contrast, previous studies that focused mainly on broadband penetration established that a 10 percentage point increase in broadband penetration contributes a gain in per capita GDP of just 0.16 to 0.25 percent.[13] Thus the GDP impact from digitization is more than twice as large as the impact of broadband penetration (see Figure 4).

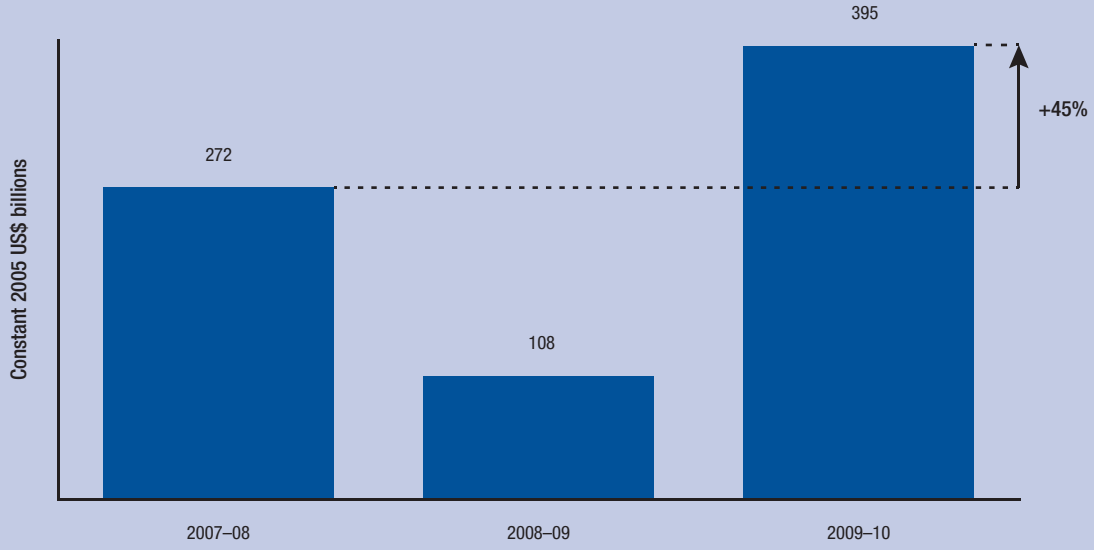
Additionally, the economic impact of digitization accelerates as countries transition to more advanced stages. Constrained digital economies realize a 0.5

Figure 4: Digitization and GDP

4a: Contribution to GDP per capita growth of a 10 percent increase in digitization (per stage)



4b: Impact of digitization on GDP



Source: Data from Global Insight, and Telecom Advisory Services; Booz & Company analysis.
* Average of OECD, Germany, Latin America, Brazil, Chile, and Malaysia.

percent increase in GDP per capita for every 10 percent increase in digitization, while advanced digital economies show a 0.62 percent increase in GDP per capita for every 10 percent digitization increase (see Figure 4).

Digitization also has a significant impact on job creation in the overall economy: an increase of 10 percent in digitization reduces a nation's unemployment rate by 0.84 percent. From 2009 to 2010, digitization added an estimated 19 million jobs to the global economy, up from the estimated 18 million jobs added from 2007 to 2008. This is an especially critical finding for emerging markets, which will need to create hundreds of millions of jobs in the coming decade in order to ensure that a booming population of young people can contribute to their national economies.

Finally, a 10-point increase in digitization results in a 6-point increase in the country's score on the Global Innovation Index[14]—a correlation suggesting that, as a country progresses in its digitization development, it also becomes more innovative.

Social impact

Assessing the impact of digitization on societies is complicated because there are no universal metrics that act as a barometer of societal advancement. Studies often tend to look at the level of inequality in a society (as measured by the Gini coefficient), but in emerging economies that are in the process of elevating millions from poverty, a complex relationship between economic growth and inequality remains. Therefore we analyzed societal impact on two levels: the level of quality of life in a society and the equality of access to basic services that a society requires. We used the widely published Gallup Wellbeing Thriving Index and the Organisation for Economic Co-operation and Development (OECD) Better Life Index to measure quality of life,[15] and the United Nations Development Programme (UNDP)'s Human Development Index (HDI) to measure access to basic services,[16] and correlated all three with the digitization levels of 150 countries.[17]

We found that increasing digitization significantly boosts societal well-being in a developed economy: a correlation run on the 34 OECD countries shows that a 10-point increase in the digitization score results in an increase of approximately 1.3 points in the OECD Better Life Index (see Figure 5). However, the analysis reveals that in countries with lower levels of economic development, the impact of digitization is not as pronounced. The difference appears to be that in less-developed economies, factors beyond digitization are more critical to quality of life: of primary importance is food; then housing, clothing, water, and energy; followed by health; and finally transportation and communication. As a result, it would appear that, as expected, digitization has an impact on quality of life only when the population has satisfied its basic needs.

Increasing digitization also supports better access to basic services, as measured by the UNDP's HDI, which tracks global access to health and education as well as overall living standards. Our analysis indicates that, as countries become more digitized, all of these measures improve (see Figure 5). Digitization's impact on the measures of health, education, and living standards is more pronounced in constrained and emerging economies, with a 10-point increase in the digitization score leading to an increase of approximately 0.13 points in the HDI. As economies develop, access to basic services becomes a given and digitization's impact is less pronounced.

To sum up, the correlational analysis suggests that digitization has an impact on social well-being, partially as a result of the increased access to basic services. However, because the populations in developing nations are confronted with the necessity of addressing some basic needs—ranging from food to shelter and basic care—that must be satisfied before they can address other issues, digitization would appear to have a less important social contribution there than it does in more advanced economies.

Governance impact

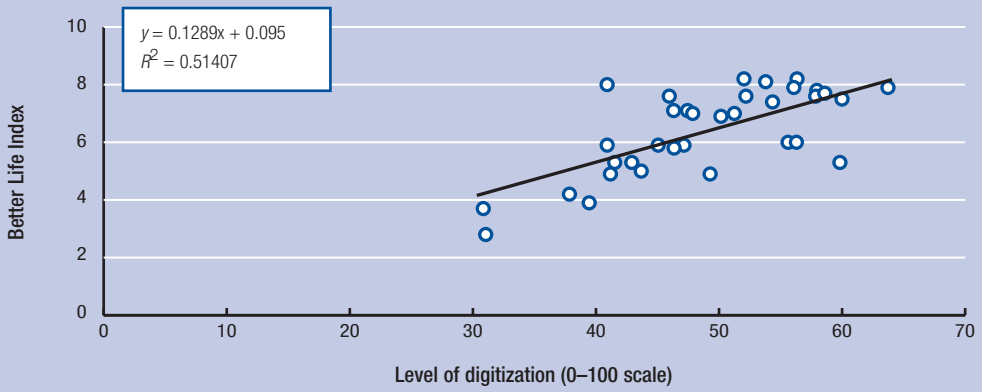
The final area in which we analyzed the impact of digitization was government effectiveness. As for the analysis reviewed above, we relied on three metrics: the transparency of governmental activities, for which we used the 2010 Corruption Perception Index published by Transparency International;[18] the delivery of e-government services, for which we used the e-government development index developed by the United Nations Public Administration Network (UNPAN);[19] and the provisioning of public education—a key government service—for which we used the Inequality-Adjusted Education Index, measured by the UNDP as a subcomponent of the HDI.[20]

Our correlational analysis demonstrates that greater digitization enables a society to be more transparent, increasing public participation and the government's ability to disseminate information in an accessible manner: a 10-point increase in digitization increases the Transparency International index by approximately 1.2 points. Digital technology gives the population more insight into government policies and function—an insight that might, in turn, lead to more active political participation and support the development of human rights.

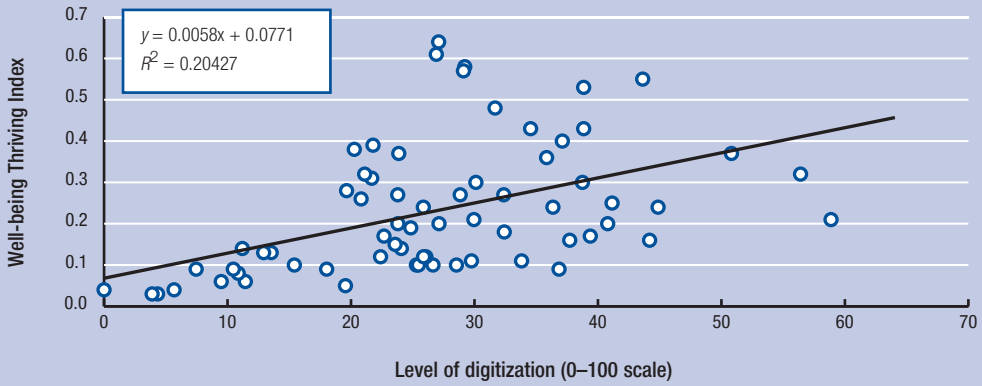
Additionally, as expected, e-government services are more effective in a digitized environment. An increase of 10 points in digitization fosters an improvement in the effectiveness of e-government services (as measured on the UNPAN E-government Development Index) by approximately 0.1 points. Current research indicates that causality in this case acts both ways. Higher digitization contributes to more efficient delivery of e-government

Figure 5: Societal well-being and digitization

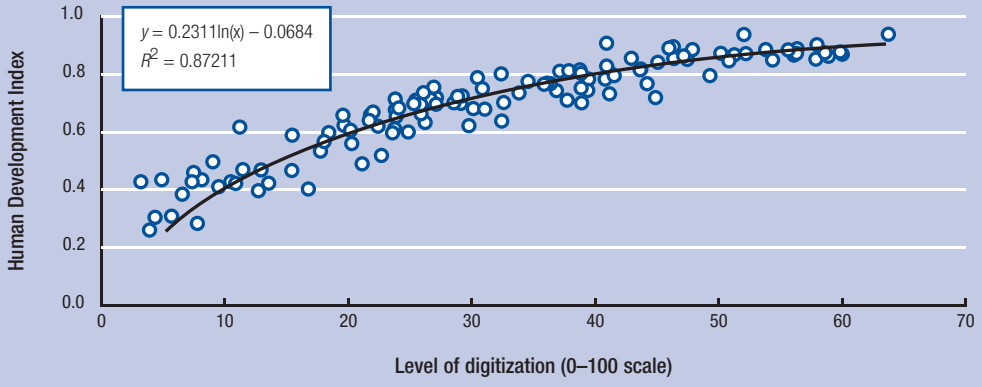
5a: Digitization and the Better Life Index (34 OECD countries)



5b: Digitization and the Wellbeing Thriving Index (67 non-OECD countries)



5c: Digitization and the Human Development Index (120 countries)



Sources: Data from the OECD Better Life Index, Gallup WellBeing Surveys, and the UNDP HDI; Booz & Company analysis.

Table 1: The impact of increased digitization

	Variable	Metrics	Positive Impact of Digitization
Economic	GDP Growth	GDP per capita: Overall	0.60%*
		GDP per capita: Constrained Stage	0.50%*
		GDP per capita: Emerging Stage	0.51%*
		GDP per capita: Transitional Stage	0.59%*
		GDP per capita: Advanced Stage	0.62%*
Society	Job Creation	Unemployment rate	–0.84%*
	Innovation	Global Innovation Index	6.27 points†
	Quality of Life	OECD Better Life Index	1.29 points†
	Access to Basic Services	UN HDI: Constrained & Emerging	0.13 points†
		UN HDI: Transitional & Advanced	0.06 points†
Governance	Transparency	Corruption Perception Index	1.17 points†
	E-government	E-government Development Index	0.10 points†
	Education	Inequality Adjusted Education Index: Constrained & Emerging	0.17 points†
		Inequality-Adjusted Education Index: Transitional & Advanced	0.07 points†

* 10 percent increase in digitization; † 10-point increase in digitization.

services, while better e-government services stimulate an increase in digitization.

Finally, digitization supports better delivery of basic government services, such as public education. As previously noted, digitization's impact on the human development indexes and subindexes is more pronounced in the case of developing countries, and a 10-point increase in digitization results in an approximately 0.17-point increase in the Inequality-Adjusted Education Index. However, this trend is projected to level out in developed countries that have access to such basic services.

Summary

Overall, our analysis indicates that digitization clearly has a positive impact on economic advancement, social well-being, and government effectiveness, although this impact varies according to a country's level of digitization. Digitization has an increasing impact on the economy and quality of life as countries advance through the stages of digitization, and more impact on access to basic services and education in countries that are just beginning their journey (see Table 1).

KEY POLICY IMPERATIVES

The digitization index and analysis will be an invaluable tool for countries to understand their current level of digitization and how to build on it.

In recent years, both developing and developed countries have invested significantly in broadband infrastructure, ensuring that their citizens have high-speed access to the Internet and communications services. But this investment is not enough. We studied the countries that have made rapid advances through the four stages of digitization to see what measures and policies contributed to their progress and found that policymakers can play a pivotal role by focusing on five key imperatives.

These imperatives are critical for all countries—both the mature economies that have reached the advanced stage of digitization, and the developing economies that fall primarily into the constrained, emerging, and transitional stages of digitization. They are:

- **Elevate digitization on the national agenda:** Ensure that national policy and senior government stewardship provide the platform for progress; create a plan for digitization that is tracked and monitored, with accountability residing at senior levels of government.
- **Evolve sector governance:** Segregate regulatory and policy roles; clarify both ownership and accountability for ICT and digitization.
- **Adopt an ecosystem philosophy:** Address the convergence of telecommunications, media, and information technology; develop a strategy that addresses all stages of the value chain in a holistic way; and consider the local ecosystem as well as export opportunities.
- **Enable sustainable competition:** Develop a competitive ICT model that stimulates both innovation and adoption, while ensuring sector sustainability and investments.
- **Stimulate demand:** Invest in boosting digitization usage and service adoption; ensure that public services are available through e-channels.

Depending on their current stage of digitization, countries will vary in how they can implement these imperatives.

Elevating digitization on the national agenda

To reach the advanced stage of digitization and realize the wide-ranging benefits it offers, countries need support from the highest levels of government. National leaders must formulate and commit to a national digitization policy, with oversight at the executive branch level. Governments need to play a leading role in setting the agenda for digitization because many participants are seeking to stake a claim in this fast-growing arena. As a result, without a coherent strategy and oversight, the sector may devolve into a "tragedy of commons" in which too many competitive stakeholders impede progress.

Governments also need to recognize the importance of the ICT sector for overall economic growth and treat it accordingly, rather than focusing on the direct tax revenues it can offer. Many developing countries still struggle to make the transition from viewing the sector as a source of tax revenue to understanding it as an enabler of socioeconomic development. But countries that have made that transition have been rewarded. For example, in recognition of its role as a vital economic enabler, Qatar has reduced the royalties paid by the telecommunications sector and as a result has incentivized investments, growing the ICT sector's contribution to Qatar's GDP by approximately 16 percent for the last five years and doubling Qatar's share of total ICT activity in the Middle East region.

Another essential element of elevating digitization to the national level is to create an effective system that measures, tracks, and demonstrates conclusively the significant impact of every dollar that is invested in it. First, policymakers need to create a detailed national- and sector-level digitization plan, clearly identifying goals, milestones, and corresponding metrics. Second, policymakers need to institutionalize systems to measure and monitor digitization progress against those plans, while creating accountability for the targets defined.

Irrespective of their stage of digitization development, most economies are still in the process of establishing the relevant metrics. Some developed countries have revised and refined their plans; for example, the United States has laid out its National Broadband Plan. Its six goals (ensuring high-speed Internet in 100 million homes, providing leadership in mobile innovation, developing a ubiquitous and robust broadband network, ensuring affordable broadband service, establishing wireless nationwide access for first responders, and enabling a clean energy economy) are intended to bring "the power and promise of broadband to us all."[21]

Evolving sector governance

Governance is another critical consideration. Countries need to effectively fulfill four complementary roles: policy, regulation, sector development, and e-enablement. Each role must maintain a distinct and dedicated function, yet must be coordinated with the others. In finding this balance, countries may choose to establish separate institutions or create clearly defined roles within an umbrella organization. Although the separate institutional model initially allows better focus and enables more effective capabilities building, countries might opt to envelop all four governance functions within a single organization to ensure synergies and efficiencies, as the United Kingdom and Qatar have done.

Countries' approach to ICT governance should also enable close collaboration between the public and private sectors, through industry forums, government and industry policy consultations, and frameworks for public-private partnerships (PPPs). Developing an effective PPP model requires countries to provide incentives for less-attractive investments while enabling the private sector to target high-return investments. For example, governments may decide to fund broadband deployment in remote areas, but let the private sector target the attractive urban areas.

Finally, effective governance will allow for close collaboration among telecommunications, media, and technology players, as well as the integration of the ICT sector with other industry verticals. Common agencies—for example, entities that consider sector governance in conjunction for players in telecommunications, media, and information technology—can support such collaboration.

Most developed countries have established strong sector governance. Singapore, for example, has successfully executed its digitization plan and grew the ICT sector by 13.6 percent between 2006 and 2008, due in part to its robust governance. The Singapore Infocomm Development Authority (IDA) is a sector regulator and pursues development; in addition, the Singapore Media Development Authority (MDA) performs the sector regulator and development role in the media sector. Both the IDA and the MDA are coordinated through the Ministry of Information, Communications and Arts.[22]

Developing countries can accelerate development of their ICT sectors by establishing a policymaking function and investing early in a sector-development arm. Saudi Arabia, for example, advanced rapidly through the stages of digitization by ensuring fulfillment of all regulatory and oversight roles at the national level.[23]

Adopting an ecosystem philosophy

Governments need to recognize the changing scope and boundaries of the sector and make policy decisions on the basis of what is best for the ecosystem as a whole. This requires policymakers to recognize the convergence among the telecommunications, media, and technology industries; the integration of the various stages of the value chain, from infrastructure to applications and usage; and the need to look beyond their local markets and capture potential export opportunities.

First, convergence among the telecommunications, media, and information technology sectors demands that governments address all three when formulating ICT policies. For example, developing markets have thus far focused primarily on telecommunications infrastructure, and as a result this sector is fairly well developed. In many developing markets, however, information technology is still lagging. For instance, in the United Arab Emirates, non-telecommunications ICT spending accounts for 21 percent of total ICT spending,[24] compared with 37 percent in developed markets such as Finland;[25] this means that there is significant untapped ICT opportunity beyond telecommunications.

Second, policymakers need to look beyond infrastructure and shift their attention to building local capabilities in creating content and applications. In Estonia, for example, by 2001 ICT companies had contributed to more than 500 million euros in annual revenues and created more than 400,000 jobs since 1999.[26] This encouraged Estonia to launch a Development Fund in 2007 to further develop its knowledge economy, investing in resources such as ICT parks and innovation centers.

Finally, in addition to developing the local ICT ecosystem, countries should explore their ability to capture export opportunities. Countries targeting export opportunities will need to build fairly robust innovation capabilities if they are to become international ICT players. Egypt, for instance, has introduced ICT into its educational system, developed e-content, created technology parks, encouraged the creation of small and medium-sized enterprises focused on ICT via developing technology incubators, and established an ICT Trust Fund that uses ICT to promote and enhance the performance of these enterprises.[27] As a result, Egypt has emerged as one of the largest ICT exporters in the Middle East and North Africa region, with 27 percent yearly growth in ICT service exports from 2005 to 2009.[28]

Enabling sustainable competition

Competition in the ICT sector fosters innovation and drives adoption—two elements that enable countries to progress in their digitization efforts.

Most developing markets see liberalization as a key mechanism to drive competition. Policymakers have favored auctions to introduce competition, while simultaneously generating revenues from finite resources such as spectrum. In Saudi Arabia, for example, Saudi Telecom preparations for market liberalization led to a 9 percent annual growth rate in digitization between 2000 and 2004. This spurred heavy investment in fixed and mobile broadband by the two main service providers, which in turn fueled a 17 percent annual growth in digitization between 2005 and 2010.

In some cases, excessive competition can backfire. In India, for example, excessive liberalization triggered aggressive competition and unsustainable returns for shareholders. In cases where intense competition and market fragmentation hinders investment and creates an innovation roadblock, policymakers should consider strategies to encourage consolidation to restore balance to the sector.

Developed economies are even considering regulated monopolies for certain telecommunications services, such as passive infrastructure, where they recognize the need for protected, utility-like returns. In such circumstances, regulators need to ensure that the monopolistic entity is well regulated and that there is significant service-level competition to spur innovation. Singapore, for example, created a regulatory framework for next-generation that effectively gave Opennet a monopoly in building and operating the country's passive networks. This framework allows regulated returns on investment in infrastructure while ensuring competition in services. Similarly, in the United Kingdom, policymakers are encouraging consolidation of the infrastructure—as evidenced by the merger of Orange and T-Mobile—while maintaining a competitive environment in services.

Stimulating demand

As countries move beyond providing access to ICT, they need to encourage the adoption of connected digital applications by individuals, businesses, and government agencies. Developing markets in the early stages of digitization should focus on boosting demand for basic telecommunications services such as fixed, mobile, and broadband across both public and private sectors. As countries move to more mature stages, governments should focus on boosting service adoption. Governments can also stimulate demand by ensuring that all public services—such as paying taxes, renewing drivers' licenses, and enrolling in school—can be performed using broadband networks.

Creating demand for ICT services requires a high level of ICT literacy and skilled human capital. Policymakers therefore can invest in digitization by providing training programs and education incentives. In addition, they can educate the population about the digital services available. Finally, they can boost usage by promoting high-speed broadband services and ensuring that these networks both are widely available and affordable.

A number of countries in advanced stages of digitization offer lessons in effectively stimulating demand. For instance, France has increased ICT spending at a yearly rate of 5 percent for the past eight years through a number of initiatives.[29] Among these are the Villes Internet association, which works with local authorities to develop Internet-literate citizens;[30] and the Comité interministériel pour la société de l'information, which was created in

2003 to encourage Internet usage, improve public services via technological innovation, and strengthen the competitiveness of French companies.[31]

CONCLUSION

It has been clear to policymakers for several years that digitization has the potential for dramatic economic, social, and political improvements. Anecdotal evidence abounds: water utilities have installed sensors that reduce leakage, saving water and money; healthcare organizations send text messages to pregnant women with advice on prenatal care, creating a healthier new generation before children are even born; fleets of trucks use digital GPS devices that direct them to shorter routes, cutting down on their greenhouse gas emissions.

The challenge for all stakeholders in the ICT ecosystem has been to quantify the impact of digitization. Numerous organizations, including the World Economic Forum with its evolution of the Networked Readiness Index, are taking steps in that direction. Our hope is that this analysis, which illustrates the need to define and measure ICT beyond broadband access, can provide an input on such efforts.

However, realizing the opportunity that broadband presents will require that policymakers undergo a shift in their thinking. They must go beyond considering ICT and focus instead on digitization, with an emphasis on ICT usage rather than just access. They must take into account their current level of digitization in order to ensure that they are focusing on the right investments to advance to the next stage. And they need to look with fresh eyes at policies that were developed a decade ago to understand how they can be updated for a new era.

Policymakers are hopeful about this opportunity, and many are committed to action. The steps they take in the coming years will determine whether they can translate opportunity into reality.

NOTES

1 See ITU's World Telecommunication/ICT Indicators, the World dataBank World Development Indicators (WDI).

2 Morgan Stanley 2009.

3 ITU's World Telecommunication/ICT Indicators and World dataBank World Development Indicators (WDI), available at http://databank.worldbank.org.

4 ITU's World Telecommunication/ ICT Indicators.

5 This attribute is the result of a combination of several measures, taken from ITU's World Telecommunication/ ICT Indicators, Hartley and Mackenzie 2009, and Wireless Intelligence.

6 This attribute is the result of a combination of several measures, taken from ITU's World Telecommunication/ ICT Indicators and the World dataBank World Development Indicators (WDI).

7 This attribute is the result of a combination of several measures, taken from ITU's World Telecommunication/ICT Indicators.

8 This attribute is the result of a combination of several measures, taken from ITU's World Telecommunication/ICT Indicators and Akamai State of the Internet report, 2010.

9 This attribute is the result of a combination of several measures, taken from the Euromonitor World Retail Data and Statistics, the UNPAN's "E-government Web measure index," ITU's World Telecommunication/ ICT Indicators, Webometrics, Bgexpert, and Internet World Stats available at http://www.economywatch.com/economic-statistics/economic-indicators/Facebook_Penetration_Rate, Wireless Intelligence.

10 This attribute is the result of a combination of several measures, taken from the UNESCO Institutes for Statistics, available at http://stats.uis.unesco.org/unesco/TableViewer/tableView.aspx?ReportId=169, and ILO LABORSTA, available at http://laborsta.ilo.org.

11 Proxy measures were used because exact and accurate data were not available. For example, the overall investments in the telecommunications sector was used as proxy to measure the reliability of the underlying network; eight metrics were used to measure usability because of the lack of data that measure actual businesses online and other more indicative metrics.

12 We developed a classic growth model to assess the impact of digitization on national and per capita GDP. This model controls for human capital and capital formation and provides an accurate snapshot of relative impact of digitization on economic development. Similarly, to assess its impact on job creation, we controlled for gross capital formation, foreign direct investment, other financial investments, and secondary school enrollment. In addition, we performed statistical tests on the index to ensure that the components and subcomponents adequately measured different features of the same underlying concept. We performed factor analysis among those tests and estimated the Kaiser-Meyer-Olkin measure of sampling adequacy.

13 See Koutroumpis 2009; Katz 2012; Katz et al. 2010.

14 Given the lack of a large established set of data for historical analysis, this analysis was based on a simple correlation. We recognize that such analysis, while providing an indication of the relationship, does not provide a sense of causality. However, these results will be able to be better measured in the near future as more data emerge. See INSEAD 2011.

15 The Gallup Wellbeing Thriving Index is available at http://www.gallup.com/poll/147167/High-Wellbeing-Eludes-Masses-Countries-Worldwide.aspx#2; the OECD Better Life Index is available at http://www.oecdbetterlifeindex.org/.

16 The UNDP Human Development Index, 2010, is available at http://hdr.undp.org/en/statistics/hdi/.

17 Again, the lack of time-series data prevented us from building a regression model.

18 Corruption Perception Index 2010 results are available at http://www.transparency.org/policy_research/surveys_indices/cpi/2010/results /.

19 UNPAN E-government Surveys are available at http://unpan1.un.org/intradoc/groups/public/documents/un-dpadm/unpan038858.pdf.

20 See the UNDP Human Development Index, 2010, available at http://hdr.undp.org/en/statistics/hdi/.

21 See the National Broadband Plan: Connecting America, available at http://www.broadband.gov/plan/.

22 See Singapore's Ministry of Information, Communications and Arts (MICA) at http://app.mica.gov.sg/ and the Singapore Telecommunications Regulator at the IDA website at http://www.ida.gov.sg/home/index.aspx.

23 See Saudi Arabia's Communication and Information Technology Commission, available at http://www.citc.gov.sa/.

24 WITSA 2010.

25 WITSA 2010.

26 Pihl 2001.

27 Egyptian Ministry of Communications Information and Technology, available at http://www.mcit.gov.eg/.

28 World dataBank, World Development Indicators (WDI).

29 WITSA 2010.

30 See the Villes Internet website at http://www.villes-internet.net/.

31 CISI 2003.

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