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***Digitization for
economic growth
and job creation***

**Regional and
industry
perspectives**

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Executive summary



Digitization — the mass adoption of connected digital services by consumers, enterprises, and governments — has emerged in recent years as a key economic driver that accelerates growth and facilitates job creation. In the current environment of a sluggish global economy, digitization can play an important role in assisting policymakers to spur economic growth and employment. Strategy&'s econometric analysis estimates that, despite the unfavorable global economic climate, digitization provided a US\$193 billion boost to world economic output and created 6 million jobs globally in 2011.¹

However, the impact of digitization by country and by sector is uneven. Developed economies enjoy higher economic growth benefits by a factor of almost 25 percent, although they tend to lag behind emerging economies in job creation by a similar margin. The main reason for the differing effects of digitization is the economic structures of developed and emerging economies. Developed countries rely chiefly on domestic consumption, which makes nontradable sectors important. Across developed economies, digitization improves productivity and has a measurable effect on growth. However, the result can be job losses because lower-skill, lower-value-added work is sent abroad to emerging markets, where labor is cheaper. By contrast, emerging markets are more export-oriented and driven by tradable sectors. They tend to gain more from digitization's effect on employment than from its influence on growth.

Policymakers can harness these varying effects of digitization through three main measures, which go beyond their current roles of setting policy and regulations. First, they should create digitization plans for targeted sectors in which they wish to maximize the impact of digitization. Second, they should encourage the development of the necessary capabilities and enablers to achieve these digitization plans. Finally, policymakers should work in concert with industry, consumers, and government agencies to establish an inclusive information and communication technologies (ICT) ecosystem that encourages greater uptake and usage of digital services.

Key highlights

- Digitization accelerates economic growth and facilitates job creation: It provided a \$193 billion boost to world economic output and created 6 million jobs in 2011.
 - Digitization's impact is not uniform across economies in different stages of development. It has a greater impact on economic growth in developed economies than in developing ones, larger by a factor of one-quarter. However, developed countries experience less employment growth compared with the developing countries.
 - Although digitization positively affects productivity across sectors, its impact on employment is uneven. Tradable sectors tend to gain more from digitization's effect on employment whereas nontradable sectors, typically large in developed economies, might lose jobs due to digitization.
 - Based on Strategy&'s analysis of six developed economies, we believe digitization has improved the productivity and output of all sectors while resulting in job losses in manufacturing and financial services and gains in retail and hospitality.
 - Policymakers need to develop digitization plans across sectors that take into consideration the varying impact by level of economic development and sector.
 - Policymakers must ensure the capabilities and enablers for sectoral digitization are in place, and need to collaborate with industry, consumers, and government to foster an ecosystem in which the uptake and usage of digital applications grow.
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Digitization's economic impact

Throughout the world, ICTs continue to proliferate at breakneck speed, but their effects are uneven across countries and sectors. In late 2011, the number of mobile telephones in the U.S. exceeded the country's population. By early 2012, the number of mobile lines worldwide was more than 6 billion — nearly as many as the global population of around 7 billion. Internet penetration is not as deep, but with global Internet access growing more than fivefold in recent years, and with increases of more than 20-fold during the past decade in regions such as the Middle East and Africa, a similar ubiquity may not be far off.

Access to ICT services is no longer the primary issue facing policymakers. Instead, the critical question is how to maximize the adoption, utilization, and impact of these services. Digitization has emerged as a key driver and enabler of socioeconomic benefits.

In 2012, we set out to quantify the impact of digitization by creating an index that scores digitization by country (see “Measuring digitization”). This analysis allows us to go beyond anecdotal evidence of the effect of digitization to measure its level and the actual impact it has on economic and social factors. The research highlights the notion that countries that have increased their digitization level have realized gains in their economies, their societies, and the functioning of their public sectors. Indeed, the more advanced a country becomes in terms of digitization, the greater the benefits — increased digitization yields improving returns. These effects are not evenly distributed by the level of economic development or by the sector.

The ability of digitization to boost output and employment has measurable global effects. Digitization has provided an additional \$193 billion to the world economy and 6 million jobs worldwide in 2011.

The most advanced economies (North America and Western Europe) accounted for approximately 29 percent of the output gain, but just 6 percent of the employment impact. Emerging economies accounted for 71 percent of the gain in gross domestic product (GDP) and 94 percent of the global employment impact (see Exhibit 1).

Exhibit 1
Digitization’s impact on GDP and jobs, 2011 regional impact

Region	GDP impact (US\$ billions)	Number of jobs created
Africa	8.3	618,699
Commonwealth of Independent States	11.8	340,820
East Asia and the Pacific	55.8	2,370,241
Eastern Europe	7.0	159,015
Latin America and the Caribbean	27.0	636,737
Middle East and North Africa	16.5	377,772
North America	25.3	167,650
South Asia	9.4	1,117,753
Western Europe	31.5	213,578
Total	192.6	6,002,266

Source: Strategy&

Impact on GDP per capita

Our analysis reveals that an increase of 10 percent in a country’s digitization score fuels 0.75 percent growth in its GDP per capita. As an economic accelerant, digitization therefore is 4.7 times more powerful than the 0.16 percent average impact of broadband deployment on per capita GDP, according to several previous studies.² Additionally, the economic effect of digitization accelerates as countries move to more advanced stages of digitization. Digitally constrained economies receive the least benefit, largely because they have yet to establish an ICT ecosystem that can capitalize on the benefits of digitization.

In 2011, East Asia, Western Europe, and Latin America received the greatest total GDP per capita impact from digitization, surpassing North America. The impact of digitization improvements in East Asia and Latin America was higher than that in North America and Western Europe, even though these regions have lower GDP impact coefficients. This is because the economies in East Asia and Latin America are still at the transitional stage and were able to achieve the biggest digitization leaps. Eastern Europe and Africa benefited the least from their digitization gains in terms of their impact on GDP.

Impact on unemployment

Digitization creates jobs, with a 10 point increase in the digitization score leading to a 1.02 percent drop in the unemployment rate. This is 4.6 times greater than the effect that the widespread adoption of broadband has on reducing unemployment; broadband cuts the unemployment rate by just 0.22 percent.³

In 2011, digitization had the greatest employment effect in constrained and emerging digitized economies. East Asia, South Asia, and Latin America received the most employment growth of all regions, with more than 4 million jobs created as a result of these regions' digitization improvements. Conversely, digitization provided little employment growth in North America and Western Europe. These advanced-stage economies probably realize fewer employment benefits because, as their digitization increases, their productivity improves; some jobs get replaced by technology; and lower-value-added, labor-intensive tasks go overseas to emerging markets where labor is cheaper.

By contrast, digitization has more significant employment effects in emerging markets for three main reasons. First, the digitization gain in some emerging regions is higher than it is in the advanced economies. Second, some of these regions have very large populations (e.g., China and India), which means that a marginal improvement in the unemployment rate leads to a large number of jobs. Finally, offshoring grows in tandem with digitization. As companies in digitally advanced countries improve their productivity thanks to digitization, they transfer jobs to digitally emerging countries.

Digitization creates jobs, with a 10 point increase in the digitization score leading to a 1.02 percent drop in the unemployment rate.

Measuring digitization

Strategy&'s Digitization Index is a composite score that calculates the level of a country's digitization using 23 indicators to measure the following six key attributes:

- **Ubiquity:** The extent to which consumers and enterprises have universal access to digital services and applications.
- **Affordability:** The extent to which digital services are priced in a range that makes them available to as many people as possible.
- **Reliability:** The quality of available digital services.
- **Speed:** The extent to which digital services can be accessed in real time.
- **Usability:** The ease of use of digital

services and the ability of local ecosystems to boost the adoption of these services.

- **Skill:** The ability of users to incorporate digital services into their lives and businesses.

The Digitization Index measures a country's level of digitization on a scale of 0 to 100, with 100 signifying the most advanced, to identify its distinct stage of digital development: constrained, emerging, transitional, or advanced.

(For more information, see "Maximizing the impact of digitization" at http://www.strategyand.pwc.com/media/uploads/Strategyand_Maximizing-the-Impact-of-Digitization.pdf).

Digitization's sectoral impact

To understand the marked differences in impact that digitization has in terms of productivity and job creation across emerging and developed economies, we first need to understand how digitization affects the functioning of any enterprise. A typical company's functions can be broken down into four areas: business, go-to-market, production, and operations. Digitization has a profound and accelerating impact across these strategies.

- **Business:** Digitization is fundamentally reshaping business models. It is lowering barriers to entry and expanding market reach for enterprises. For example, it is possible for Skype to provide telephony to more than 500 million users globally using voice over Internet protocol (VoIP) technology, fundamentally disrupting business models for operators worldwide and forcing many to launch their own VoIP business models in response.
- **Go-to-market:** Digitization is changing how companies build brands and products, communicate, and provide services to their customers. Companies are increasingly relying on social media to build brands. More and more, subscribers are forming their purchase opinions online, even for items that they then buy offline. Close to 40 percent of those online actually use the Web to research items that they buy in physical outlets. Digitization is also enabling companies to create products tailored to customers' tastes. For example, BMW offers a build-your-own-BMW online service, which allows for more than a

million different combinations in the finished product. The role of the Web as a retail channel is causing substantial disruptions, with companies significantly expanding market reach, leading to the emergence of new winners and losers. Starting from roughly the same position in 2001, Amazon.com grew its annual sales from \$3.1 billion to \$48 billion in 2011, while the bricks-and-mortar retailer Borders lost market share and ultimately filed for bankruptcy.

- **Production:** Digitization is also changing the way companies manage their production assets. It has enabled companies to move labor-intensive tasks to emerging economies while competing to develop the best design and user interface. For example, Samsung acts as a supplier to Apple for its iPhone products, but both compete aggressively in the consumer market by trying to differentiate themselves in their design and user interface. Digitization is also leading to the emergence of new manufacturing technologies, with the advent of 3-D printing creating a new way to manufacture complex products and leading to the import of jobs back to developed economies.
- **Operations:** Finally, digitization has had the greatest impact on the way companies organize and operate to generate competitive advantage. Digitization has created more global entities, seamlessly in touch across continents, and has redefined the concept of office space. One in four American workers regularly telecommutes, a fact that has a profound impact on how companies organize and manage resources. Digitization is also allowing companies to outsource or completely automate a number of their back-end functions, enabling them to become more efficient.

The type and extent of the impact that digitization has on a sector of the economy is determined mainly by the interaction of the four areas outlined above. For example, if digitization significantly enhances market access, then job growth will be more likely in that sector. However, if digitization primarily drives efficiency growth but does not lead to new market creation, then that sector is likely to lose jobs.

Digitization has had the greatest impact on the way companies organize and operate to generate competitive advantage.

To better understand these dynamics, we examined five key economic activities in developed markets that would yield conclusions that can guide policy responses. We identified these five areas by initially dividing the overall economy into three major sectors: primary, secondary, and tertiary.⁴ The primary sector relates to agriculture, farming, and mining — the extraction, collection, and primary processing of natural materials. The secondary sector encompasses manufacturing — the making, building, and assembling of finished products. The tertiary sector provides services to consumers and businesses and includes retailers, transportation and entertainment companies, banks, and healthcare providers.

We focused our analysis on subsectors in the secondary and tertiary sectors, where activities affected by digitization tend to cluster — financial services, manufacturing, retail, and hospitality (digitization has less effect on the primary sector). We also looked at the impact on the overall services sector. We looked at these subsectors in six advanced-digitization countries — which are also developed economies and members of the Organisation for Economic Co-operation and Development (OECD) — Australia, Germany, Norway, Sweden, the U.K., and the U.S. Our econometric analysis used three industry metrics: output, productivity, and employment. Output measures the subsector’s contribution to GDP. Productivity determines the subsector’s level of value-added per employee. Employment tracks the number of workers in each subsector.

This analysis allows an understanding of how the positive national effect of digitization plays out differently in economic subsectors. For example, we estimate that, in Germany, approximately 8.7 percent of the rate of change in GDP between 2010 and 2011 is attributable to advances in digitization. Its contribution to employment was lower: 7.7 percent of the jobs added in Germany between 2010 and 2011 came from increased digitization. There is a clear relationship between productivity gains and job losses, as shown by the results for financial services and manufacturing. By contrast, other subsectors increased employment and output, although their productivity grew at a slower pace (*see Exhibit 2, page 13*).

There is a clear relationship between productivity gains and job losses, as shown by the results for financial services and manufacturing.

As digitization increases, financial services gain the most in terms of output and productivity. Increased digitization, however, cut jobs in financial services and manufacturing because productivity gains surpassed output gains. Conversely, digitization created jobs in services subsectors, with particularly notable gains in the hospitality and retail subsectors.

Exhibit 2
Digitization impact on output, productivity, and employment

Impact by Industry, Developed Markets¹

Sector	Industry output (% growth)	Industry productivity (% growth)	Industry employment (implied)
Financial Services	1.98	2.82	↓
Manufacturing	1.19	1.79	↓
Retail	1.34	0.71	↑
Services ²	1.27	1.00	↑
Hospitality	1.52	0.41	↑

¹ Data are from six OECD countries: Australia, Germany, Norway, Sweden, the U.K., and the U.S. This data is based on a 10 percent increase in digitization.
² Services refers to overall services other than financial services.

Source: Strategy&

Although there are insufficient data to study how digitization leads to job creation in certain sectors in emerging markets, evidence from two closely knit economies — the U.S. and Mexico — illustrates the overall trend (see Exhibit 3). Financial services and manufacturing businesses in the U.S. shed jobs because they were able to transfer labor-intensive or support activities to Mexico, where labor costs are lower. Companies took advantage of offshoring for operations, logistics, customer care, legal, and communications services. The productivity gains in financial services and manufacturing were a result of this ability to decrease labor costs while increasing output. The net result was a 6 percent decline in the number of jobs in the U.S. tradable sectors between 2002 and 2009 and a concomitant 15.2 percent increase of employment in tradable sectors in Mexico during the same years.⁵

Exhibit 3
Digitization impact on employment in closely knit economies

Employment growth by industry, Mexico and U.S. (2006–08)

Sector	U.S. (% growth)	Mexico (% growth)
Financial services	-3 	16 
Manufacturing	-5 	2 
Retail	2 	5 
Services ¹	2 	7 
Hospitality	2 	13 

¹ Services refers to overall services other than financial services.

Source: Strategy&

The effect on retail — rising employment with some output and productivity growth — demonstrates how a proper measurement of digitization is superior to anecdotal evidence. A superficial look indicates that small retailers are closing because of online shopping. Instead, advancing digitization in retail actually creates new markets and new employment opportunities. Retailers are expanding internationally. As their reach spreads, their supply chains become more complex and require more people to manage them. The impact on the hospitality industry is similar, with new business models emerging and new markets created. Digitization allows for improved inventory management and higher occupancy rates, both of which are useful when dealing with nonfungible items such as airline seats or hotel rooms.

The extent of productivity gains experienced by the subsectors is also highly correlated with the extent of digitization seen in these sectors. In Strategy&'s 2011 publication, *Measuring Industry Digitization: Leaders and Laggards in the Digital Economy*, we established that the most digitized sector is financial services, followed by manufacturing, retail, and hospitality.⁶ Productivity impact in these sectors follows the same order, with financial services leading the pack and hospitality benefitting the least of the sectors covered.

Advancing digitization in retail actually creates new markets and new employment opportunities.

Policy implications

As the spread and depth of digitization increases globally, so do its roles as a key driver of growth and as a source of national competitive advantage. Policymakers have focused until now on improving the reach and affordability of ICT services — most recently facilitating, and even investing in, large-scale broadband deployment. Though important, this is just one part of the story. Policymakers in the future need to become digital market makers — creators of a digital economy that provides its citizens, enterprises, and economic sectors with the competitive advantage essential to thrive in an increasingly global market.

Becoming a digital market maker requires policymakers to undertake three activities: designing sector digitization plans, building capabilities, and jump-starting and monitoring the wider digitization ecosystem (see *Exhibit 4, page 17*). In designing sector digitization plans, policymakers should seek to develop competitive advantage and generate jobs in sectors that are already critical to the national economy. Policymakers should then foster the development of capabilities and enablers necessary to achieve these digitization plans. Finally, policymakers should work in concert with industry, consumers, and government agencies to jump-start and continuously monitor an inclusive digitization ecosystem that will encourage the uptake of digital applications in these sectors and that will keep them competitive.

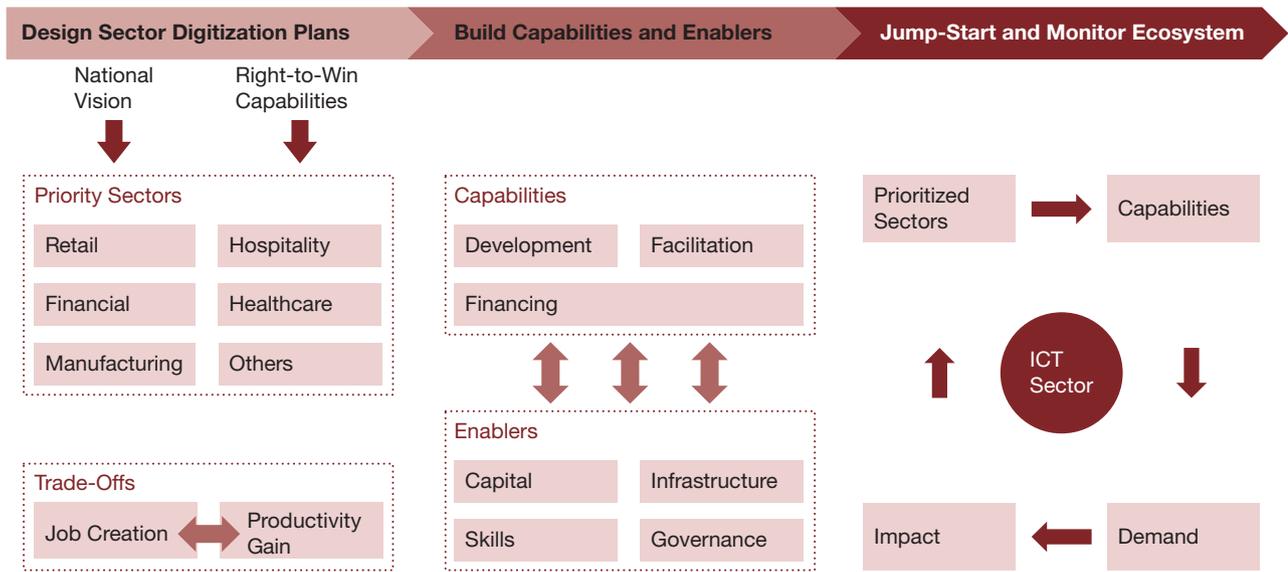
Design sector digitization plans

The rapidly accelerating pace of digitization means that policymakers are not in a position to be able to spread their efforts across all sectors. First they must determine which sectors will provide, or are providing, national competitive advantage and decide how digitization can reinforce these trends. Second, they need to explicitly understand the trade-offs between job creation and productivity growth that increasing digitization will bring. For example, accelerating digitization in manufacturing in most OECD countries will lead to significant productivity gains, but also job losses. Finally, policymakers need to work closely with national leaders to identify and understand these trade-offs up front, and then work on mechanisms to offset potential job losses.

For example, Singapore’s digitization agenda seeks to increase competitiveness in targeted sectors while promoting social welfare. In particular, ports play a vital role in this export-driven island economy. The Infocomm Development Authority of Singapore and the Maritime and Port Authority of Singapore (MPA) have therefore jointly launched WISEPORT, the world’s first port WiMax (a fast wireless standard) network that provides coverage within 15 kilometers of the southern coastline. In addition, the MPA has established a fund that encourages maritime technology, resulting in digital initiatives such as the intelligent bunker management system and SingTel AlTrac, a secure global satellite tracking system, built by the incumbent operator SingTel.

Exhibit 4
Sector digitization plans and capability design needs

Digital Market Makers’ Approach



Source: Strategy&

Build capabilities

Becoming a digital market maker requires policymakers first to adopt a holistic ecosystem perspective. ICTs range beyond basic infrastructure, and policymakers need to look at a multilayered ICT ecosystem categorized in 42 buckets to understand what role they need to play in each to enable creation of digital markets (*see Exhibit 5*).

Where the private sector does not have sufficient incentive to undertake the development of critical digital infrastructure, the state needs to play the role of a developer, becoming a participant in the market — either directly or through a public–private partnership. Finland, for example, has developed the VTT Technical Research Centre, which provides multidisciplinary research and development services to both the public and private sectors. In another case, Malaysia has launched the MyHealth initiative, which allows online provision of a range of healthcare services to the nation’s population.

Where there are opportunities for the private sector but the risks are high or the returns are not guaranteed, the state can play the role of financier. Examples include Australia’s Digital Enterprise initiative, which seeks to increase digital participation by small and medium-sized enterprises and civil society organizations.

If there are opportunities and the private sector is undertaking the necessary activities, the state can play the role of a facilitator — a role with functions that range from being a regulator to being a demand stimulator of digital services. Examples here include the training programs launched by telecommunications authorities in Japan and South Korea.

Choosing which role to play and finding the right partnerships for executing that role represent a new set of capability challenges for policymakers. Building a digital market would require them to master all three capabilities and then identify, in a targeted manner, which roles they will play and in which sectors.

Finally, the ability to play these roles will be influenced by the presence (or absence) of basic enablers in the economy: capital, access to cutting-edge thinking, and digital infrastructure. Policymakers need to ensure the development of world-class research bodies; the availability of seed and venture capital; and the development of reliable, high-quality infrastructure. For example, Saudi Arabia is trying to develop world-class research institutes in the King Abdullah University of Science and Technology, while also setting up an incubator in the King Abdulaziz City for Science and Technology and working with operators to ensure the availability of high-speed digital infrastructure. Another example is

Where the private sector does not have sufficient incentive to undertake the development of critical digital infrastructure, the state needs to play the role of a developer, becoming a participant in the market

Exhibit 5
A holistic ecosystem perspective

Layer 1	Layer 2	Layer 3	Layer 4
Information technology	Services	Managed services	Application management services Hosting infrastructure services Research & development
		Integration services	Systems integration Product assembly
		Support services	Maintenance & support IT consulting ICT education & training
		Online services	Online platforms
	Software	Software development	Packaged applications Gaming Customized applications Systems software
	Digital media	Digital content	Content creation Content aggregation Content distribution
	Hardware	End-user equipment	PCs & peripherals Laptops Tablets Handheld devices Multimedia devices
		IT equipment	Data center equipment (servers, storage, etc.) Networking equipment (routers, hubs, switches, etc.)
		Hardware components	Semiconductor devices Electronic components Microprocessor devices Sensors (RFIDs, M2M, etc.)
	Communication	Service provision	Wireless
Wireline			Wireline operators ISPs Support services
Interconnection			Terrestrial Submarine Satellite Support services
Network equipment (hardware & proprietary software)		Wireless	Wireless network equipment
		Wireline	Wireline network equipment
		Interconnection	Cable Satellite

¹ Wireless support services include operations and maintenance, and data clearing.

Note: ISP = Internet service provider; M2M = machine to machine; MVNO = mobile virtual network operator; RFID = radio-frequency identification.

Source: Strategy&

Germany's ICT 2020 plan, which provides funding to small and medium-sized businesses engaged in research and development activities within the ICT sector.⁷

Jump-start and monitor the wider digitization ecosystem

The challenge for all stakeholders has been to monitor the execution and the impact of the digital ecosystem. Investing in digitization requires more than a leap of faith; it necessitates that policymakers measure, track, and demonstrate conclusively the significant impact of every dollar that is invested in digitization. This is especially critical now, when most countries in the developed world are gripped by fiscal austerity measures. A partnership that includes institutions such as the International Telecommunication Union, the United Nations, the OECD, Eurostat, and the World Bank has defined a list of 48 core ICT indicators in an attempt to harmonize tracking at a global level.⁸

Policymakers need to institutionalize systems to measure and monitor the progress of ICTs, and monitor the progress of digitization against those plans, while creating accountability for their digitization targets. This is a challenging process for two reasons. First, monitoring the progress of a national plan takes years and requires balancing social and economic interests. Policymakers need to ensure that government leaders fully understand and endorse the measurements, goals, and trade-offs between these interests. Second, there is currently no standard, replicable tool to measure digitization on which policymakers, economists, and private-sector stakeholders agree. Policymakers need to invest the time and effort required to ensure that all sector participants agree to a consistent set of metrics.

Investing in digitization requires more than a leap of faith; it necessitates that policymakers measure, track, and demonstrate conclusively the significant impact of every dollar that is invested in digitization.

Conclusion

Ever since Adam Smith proposed the theory of absolute advantage enjoyed by a country in producing a good or service, policymakers have sought to build and maintain this advantage in key sectors of their economies. Digitization is emerging as a new tool to build and sustain such absolute advantages, and in some cases even to claim the “right to win” and beat the competition in certain sectors — a critical capability that underpins all other national economic efforts.

Creating digital markets and boosting digitization can yield significant economic benefits and lead to substantial social benefits to societies and communities. Digitization has the potential to boost productivity, create new jobs, and enhance the quality of life for society at large. For example, if emerging markets could double the Digitization Index score for their poorest citizens over the next 10 years, the result would be a global \$4.4 trillion gain in nominal GDP, an extra \$930 billion in the cumulative household income for the poorest, and 64 million new jobs for today’s socially and economically most marginal groups. This would enable 580 million people to climb above the poverty line.⁹

If policymakers want to capture these rich returns, then they need to go back to the drawing board and figure out how they can build their digital markets — the markets where the bulk of the world’s information and goods will be bought and sold in the upcoming decade of digitization.

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² Koutroumpis 2009; Katz and Koutroumpis 2012; Katz et al. 2010.

³ Koutroumpis 2009; Katz and Koutroumpis 2012; Katz et al. 2010.

⁴ For an explanation of these three sectors, see The Times 100 Business Case Studies (<http://businesscasestudies.co.uk/business-theory/strategy/primary-secondary-and-tertiary-activity.html#axzz2EifjmtUr>).

⁵ OECD.Stat (<http://stats.oecd.org/>).

⁶ Friedrich et al. 2011.

⁷ BMBF 2007.

⁸ For more on the core list of indicators, see <http://www.itu.int/ITU-D/ict/coreindicators/index.html>.

⁹ El-Darwiche et al. 2012.

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