

Digital Technologies

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Abstract—Digital technologies have elaborated expanded the information base, lowered information costs, and created information goods. This has facilitated searching, matching, and sharing of information and contributed to greater organization and collaboration among economic agents—*influencing how firms operate, people seek opportunities, and citizens interact with their governments.* Six major digital technologies are: Fifth-generation (5G) mobile phones, Artificial intelligence, Robotic, Internet of things, Autonomous vehicles, 3D printing. Adopting 5G will require using parts of the spectrum above 3 gigahertz (GHz), and in the millimeter band that stretches from 30–300 GHz with a new antennae. Faster computing, “big data,” and better algorithms have helped artificial intelligence (AI) to bring new opportunities for collaboration between humans and machines. Industrial robots are highly concentrated in transport equipment, electronic, electrical and optical equipment. The “Internet of things” (IoT) refers to the interconnection of objects to internet infrastructure through embedded computing devices, such as radio frequency identification (RFID) chips and sensors. Five broad categories of IoT are: wearable devices, smart homes, smart cities, environmental sensors, and business applications. 3D printing, a process whereby machines can print objects from digital files or scans, consists of adding successive layers of material to make a three dimensional (3D) object .3D printing has advanced to printing of body parts (titanium jaws, spines), exoskeletons, rocket parts, and even food. Digital technologies have often been called on to help meet supply chain needs, but not all have brought the expected widespread benefits. The poor benefit from digital technologies. Nearly 7 of 10 people in the bottom fifth of the population in developing countries own a mobile phone, improving their access to markets and services

Introduction

Digital technologies—the internet, mobile phones, and all the other tools to collect, store, analyze, and share information digitally—have spread quickly. More households in developing countries own a mobile phone than have access to electricity or clean water, and nearly 70 percent of the bottom fifth of the population in developing countries own a mobile phone. The number of internet users has more than tripled in a decade—from 1 billion in 2005 to an estimated 3.2 billion at the end of 2015. This means that businesses, people, and governments are more connected than ever before. Digital technologies explores the impact of the internet, mobile phones, and related technologies on economic development.

Digital Technologies and Internet

Internet promotes development and digital technologies can make development more inclusive, efficient, and innovative. The Internet is profoundly shaping modern society. It facilitates interconnectivity between individuals and information, and has important impacts on society, the economy and culture. At no other time in history has global communication and access to information been so pervasive. The Internet began as an important tool for improving communication but has transformed into an ubiquitous technology supporting all sectors across the economy. To evoke the key economic role that the Internet has gained in recent years, the term Internet economy has become a widely used expression. Internet promotes Development and digital technologies can make development more inclusive, efficient, and innovative.

Digital technologies have dramatically expanded the information base, lowered information costs, and created information goods. This has facilitated searching, matching, and sharing of information and contributed to greater organization and collaboration among economic agents—*influencing how firms operate, people seek opportunities, and citizens interact with their governments.* The changes are not limited to economic transactions—they also influence the participation of women in the labor force, the ease of communication for people with disabilities, and the way people spend their leisure. By overcoming information barriers, augmenting factors, and transforming products, digital technologies can make development more inclusive, efficient, and innovative.

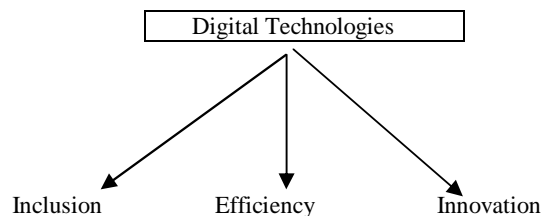


Figure 1: Digital technologies makes development inclusive, efficient, and innovative.

The internet promotes development through three main mechanisms:

1. Inclusion,
2. Efficiency
3. Innovation

Inclusion

By reducing the cost of acquiring information and making more information available transparently, digital technologies can make new transactions possible.⁷ C Mobile phone records, e-commerce, the sharing economy, online reputation mechanisms, and digital identification systems all help to overcome the information barriers. While they make the market more efficient, the biggest benefit seems to be their market creation effects: expanding trade, creating jobs, and increasing access to public services—and thus promoting inclusion.

Efficiency

Perhaps the largest impact has been on transactions that existed before the arrival of the internet but are now quicker, cheaper, or more convenient to carry out. This mechanism operates in two ways. First, the dramatic decline in the price of digital technologies has led businesses and governments to replace existing factors—labor and non-ICT capital—with ICT capital and to automate some of their activities

Innovation

The extreme case of efficiency is when transactions are executed automatically, without human input, and transaction costs fall to essentially zero. The zero marginal cost attracts new sellers and buyers to the firm’s platform, creating virtuous network effects, where the benefit to a buyer increases as more sellers join in, and vice versa.

Digital Dividends and Digital Technologies

Digital technologies have spread rapidly in all over the the world. Digital dividends—that is, the broader development benefits from using these technologies—have lagged behind. Digital technologies have boosted growth, expanded opportunities, and improved service delivery. Yet their aggregate impact has fallen short and is unevenly distributed.

Table 1: Digital Dividends and Digital Technologies

Digital dividends	Growth, jobs, and services are the most important returns to digital investments. Digital technologies help businesses become more productive; people find jobs and greater opportunities; and governments deliver better public services to all.
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Digital technologies promote development and generate digital dividends	By reducing information costs, digital technologies greatly lower the cost of economic and social transactions for firms, individuals, and the public sector. They promote innovation when transaction costs fall to essentially zero. They boost efficiency as existing activities and services become cheaper, quicker, or more convenient. And they increase inclusion as people get access to services that previously were out of reach.
Digital dividends are not spreading rapidly enough	Digital dividends are not spreading rapidly enough for two reasons. First, nearly 60 percent of the world’s people are still off line and can’t fully participate in the digital economy. There also are persistent digital divides across gender, geography, age, and income dimensions within each country. Second, some of the perceived benefits of the internet are being neutralized by new risks.
What countries should do to mitigate risks?	Connectivity is vital, but not enough to realize the full development benefits. Digital investments need the support of “analog complements” : regulations, so that firms can leverage the internet to compete and innovate; improved skills, so that people can take full advantage of digital opportunities..
Connecting the unconnected	Market competition, public-private partnerships, and effective regulation of internet and mobile operators encourage private investment that can make access universal and affordable. Public investment will sometimes be necessary and justified by large social returns. A harder task will be to ensure that the internet remains open and safe

Digital development strategies need to be broader than ICT strategies. Connectivity for all remains an important goal and a tremendous challenge. But countries also need to create favorable conditions for technology to be effective. When the analog complements are absent, the development impact will be disappointing. But when countries build a strong analog foundation, they will reap ample digital dividends—in faster growth, more jobs, and better services.

Major Digital Technologies

Digital technologies have spread rapidly in all over the the world. Six major digital technologies are:

1. Fifth-generation (5G) mobile phones
2. Artificial intelligence
3. Robotics
4. Autonomous vehicles
5. Internet of things
6. Internet of things

Fifth-generation (5G) mobile phones-5G wireless networks are the next generation of mobile networks. 5G networks are expected to outperform current 4G networks by providing data

at a speed several hundred gigabits per second (G bit/s). Accommodating 5G will require using parts of the spectrum that have not previously been considered commercially useful, in particular above 3 gigahertz (GHz), and in the millimeter band that stretches from 30–300 GHz. It will also require new kinds of antennae. Developments in smart phones have increased capabilities about 25 percent per year in the past five years. Even though mobile itself is hardly a new technology, it is its combination with the internet that makes it a disruptive force and one of the technologies with potentially the greatest impact for the developing world. Developing countries will need to closely follow developments taking place in 5G and start preparing for its eventual rollout.

Artificial intelligence -Definitions of artificial intelligence (AI) differ widely, but generally refer to computer systems that can perform tasks that normally require human intelligence— including visual and speech recognition, decision making, and language translation. Faster computing, “big data,” and better algorithms have helped propel recent breakthroughs in AI. Advances in AI will prove to be disruptive, resulting in new opportunities for collaboration between humans and machines, as well as a loss of traditional jobs such as legal analysts, financial and sports reporters, online marketers, anesthesiologists, diagnosticians, and financial analysts.

Robotics-. Among OECD countries, Japan, the US, Korea and Germany are the most “robotised” countries in the OECD and together account for almost 70% of the total number of operational robots. In terms of the adoption of industrial robots by sector, the use of industrial robots is the most highly concentrated in transport equipment with almost 45% of the total stock of robots, followed by electronic, electrical and optical equipment, with almost 30. Thirteen (13) Robots have been deployed in the Democratic Republic of Congo, in Kinshasa, to manage traffic

Autonomous vehicles-Autonomous vehicles (AV), or self-driving cars, attract major research spending from car companies as well as internet firms. Their proponents argue that they will reduce road accidents (for instance, through lane-keeping systems, auto-parking, and cruise control), ease congestion, reduce fuel consumption, improve the mobility of the elderly and disabled, and free up commuting time for other tasks.

Internet of things- The “internet of things” (IoT) refers to the interconnection of objects to internet infrastructure through embedded computing devices, such as radio frequency identification (RFID) chips and sensors. IoT products can be classified into five broad categories: wearable devices, smart homes, smart cities, environmental sensors, and business applications. IoT is quickly redefining service delivery and unlocking opportunities in multiple areas. Smart fitness sensors and trackers are transforming health care and improving personal fitness and health. Embedded sensors accurately relay moisture, air and water pollution levels, and

resource levels, allowing for closer monitoring of environmental problems. Factories and supply chains use smart sensors to improve the efficiency of manufacturing and distribution of goods.

3D printing-3D printing, a process whereby machines can print objects from digital files or scans, consists of adding successive layers of material to make a three dimensional (3D) object. This technology has transformational potential for manufacturing, since it enables users to create smaller batches of highly customizable products at declining prices. In recent years, 3D printing has advanced to printing of body parts (titanium jaws, spines), exoskeletons, rocket parts, and even food. As prices have fallen, consumer-oriented devices have appeared on the market in recent years, allowing individuals to make three-dimensional solid objects locally, often using a computer-assisted design (CAD) file that can be downloaded from the internet. The “ink” used in the printer is usually plastic, but other materials—including epoxy resins, silver, titanium, steel, and wax—are also available. The revolutionary aspect of 3D printing lies in its digital nature: physical objects become digital information that can be remixed, reformulated, improved, and shared.

Block chain is a digital “ledger” technology that allows for keeping track of transactions in a distributed and trusted fashion. It replaces the need for third-party institutions to provide trust for financial, contract, and voting activities. Bit coin and other digital currencies are some of the most well-known examples of applications of block chain technology. Fourth Industrial Revolution have a massive impact on the economy as seen by, rise of the sharing economy, block chain technology, and changes in manufacturing driven by 3D- and 4D-printing.

The sharing economy is a model in which people and organizations connect online to share goods and services. It is also known as collaborative consumption or peer-to-peer exchange. Two of the best-known examples of the sharing economy are Uber (transportation) and Airbnb (housing).

The risks: Concentration, inequality, and control

Many problems and failures of the internet surface when digital technology is introduced but the important analog complements remain inadequate. What are these complements? The main ones are regulations that ensure a high degree of competition, skills that leverage technology, and institutions that are accountable. Without strong analog complements, opportunities may turn into risks

The interplay between internet investments and reforms in complementary areas is at the core of policy debates about technology impacts.

- When the internet delivers scale economies for firms but the business environment inhibits competition, the outcome could be excessive concentration of market

power and rise of monopolies, inhibiting future innovation.

- When the internet automates many tasks but workers do not possess the skills that technology augments, the outcome will be greater *inequality*, rather than greater efficiency.
- When the internet helps overcome information barriers that impede service delivery but governments remain unaccountable, the outcome will be greater control, rather than greater empowerment and inclusion.

Table 2: The risks: control, inequality, and concentration

Digital Technologies		
Information without accountability	Automation without skills	Scale without competition
↓	↓	↓
Control	Inequality	Concentration

Influence of digital technologies on the lives of poor people.

World Development Report 2016: Digital Dividends, states that the poor can contribute to development, and create opportunities for inclusion, efficiency and innovation. The benefits of rapid digital expansion have been skewed towards the wealthy, skilled, and influential around the world, who are better positioned to take advantage of the new technologies. The digital divide in the world is still substantial, and those who are better educated or have stronger skills benefit more from the development of information technologies. For digital technologies to benefit everyone everywhere, greater digital adoption will not be enough. Work is also needed on the “analog complements”: countries should strengthen regulations, adapt workers’ skills to the demands of the new economy, and ensure that institutions are accountable.

Digital technologies are spreading rapidly, but digital dividends – growth, jobs and services – have lagged behind. If we wish to create a future built on shared prosperity, digital technology will be critical.

Technology can be a force for good — by promoting economic inclusion, efficiency, and innovation. But it can also cause upheaval — by displacing jobs or imperiling the security of personal and government data, and even critical infrastructure. And it can widen the digital divide — increasing the gap between those who benefit from technology and those who are excluded and risk falling further behind. That’s why technology’s risks and opportunities must be carefully managed. Information technologies permeate our lives, and have tremendous potential when strengthening development. Much of the world is reaping digital dividends

today: companies benefit through economic growth, people benefit through new jobs, and governments are enabled to deliver better services.

The dividends: Growth, jobs, and service delivery

The benefits of digital technologies filter throughout the economy. For businesses, the internet promotes inclusion of firms in the world economy by expanding trade, raises the productivity of capital, and intensifies competition in the marketplace, which in turn induces innovation. It brings opportunities to households by creating jobs, leverages human capital, and produces consumer surplus. It enables citizens to access public services, strengthens government capability, and serves as a platform for citizens to tackle collective action problems. These benefits are neither automatic nor assured, but in numerous instances digital technologies can bring significant gains .

Table 3: Inclusion, Efficiency, innovation. the three mechanisms applied to businesses, people, and governments

	Digital Technologies		
	Inclusion	Efficiency	Innovation
Business	Trade	Capital utilization	competition
People	↓	↓	↓
	Job opportunities	Labor productivity	Consumer welfare
Governments	↓	↓	↓
	Participation	Public sector capability	voice

Fourth Industrial Revolution

The exponential growth in digitization and internet connectivity is the backbone of the *Fourth Industrial Revolution*. It has the potential to propel societies forward, enable innovative business models and help governments address legitimate policy concerns. Digitization is transforming business models, the policy landscape and social norms.

The term ‘Industry 4.0’ stands for the fourth industrial revolution. Industry 4.0 is driven by:1) Digitisation and integration of vertical and horizontal value chains It includes technologies from track and trace devices to real-time integrated planning with execution. 2) Digitisation of product and service offerings.

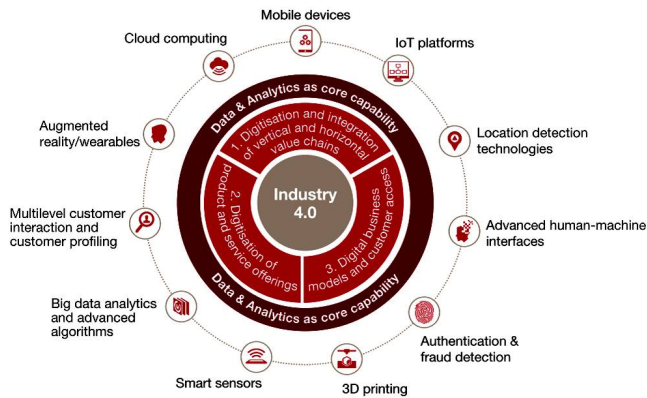


Figure 2: Industry 4.0 framework and contributing digital technologies

Source: Industry 4.0: Building the digital enterprise

CONCLUSION

Internet promotes development and digital technologies can make development more inclusive, efficient, and innovative. Six major digital technologies are: Fifth-generation (5G) mobile phones, Artificial intelligence, Robotic, Internet of things, Autonomous vehicles, 3D printing. Digital technologies can transform our economies, societies and public institutions, but these changes are neither assured nor automatic, Countries that are investing in both digital technology and its analog complements will reap significant dividends, while others are likely to fall behind. Technology without a strong analog foundation risks creating divergent economic fortunes, higher inequality and an intrusive state.

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