

Emergence of Digital Economy

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Abstract—Digital economy refers to an economy that is based on digital computing technologies. Three main components of the 'Digital Economy' concept are: e-business infrastructure, e-business and e-commerce. The 'digital economy'—defined as “that part of economic output derived solely or primarily from digital technologies with a business model based on digital goods or services”—consists of the digital sector plus emerging digital and platform services. The digital economy is unevenly distributed. The digital economy is growing faster than overall economies. The digital economy contributes significantly to employment. Data as a source of value is a key feature of the digital economy. Data are collected from several market players and activities. The increasing capacity to collect, store and treat massive flows of data has led to the concept of “big data” that could generate value either in private (marketing) or public (government) activities. Network effects are pervasive in the digital economy. They have allowed private value creation especially through so-called multi-sided business models. In those models, several groups of persons interact through a platform, resulting in positive or negative externalities. Economy Outlook examines and documents evolutions and emerging opportunities and challenges in the digital economy. It highlights how OECD countries and partner economies are taking advantage of information and communication technologies (ICTs) and the Internet to meet their public policy objectives. According to OECD, the digital economy enables and executes the trade of goods and services through electronic commerce on the internet. European Union consider digital economy as “the single most important driver of innovation, competitiveness and growth in the world. The World Development Report 2016 Digital Dividends, highlights many instances of how e-commerce is boosting the employment opportunities of those who may have been excluded from the global market place. According to the report, the internet enables many small firms to participate in global trade, thus leading to more inclusion

1. INTRODUCTION

The digital economy is the worldwide network of economic activities, commercial transactions and professional interactions that are enabled by information and communications technologies (ICT). Digital technology in the form of the Personal Computer and the Internet has already transformed work, education, government, leisure and entertainment, generating new market opportunities and having a major economic impact across a broad range of sectors.

2. DIGITAL ECONOMY

Digital economy refers to an economy that is based on digital computing technologies. Three main components of the 'Digital Economy' concept are: e-business infrastructure, e-business and e-commerce. Digital economy is also called the Internet Economy, the New Economy, or Web Economy. The core of the digital economy is the 'digital sector': the IT/ICT sector producing foundational digital goods and services. The true 'digital economy' – defined as “that part of economic output derived solely or primarily from digital technologies with a business model based on digital goods or services” – consists of the digital sector plus emerging digital and platform services. The widest scope – use of ICTs in all economic fields – is referred to as the 'digitalised economy'

Data as a source of value is a key feature of the digital economy. Data are collected from several market players and activities. The increasing capacity to collect, store and treat massive flows of data has led to the concept of “big data” that could generate value either in private (marketing) or public (government) activities.

According to OECD, the digital economy enables and executes the trade of goods and services through electronic commerce on the internet. European Union consider digital economy as “the single most important driver of innovation, competitiveness and growth in the world. Digital economy is the economy that “can provide a high quality of ICT infrastructure and harness the power of ICTs to benefit consumers.

Five major technology trends have collided to shape what is becoming known as the digital economy: Hyper-connectivity, supercomputing, cloud computing, cyber security, and smart products have created a world where the traditional boundaries of products vs. service offerings no longer exist.

3. INTERNET ECONOMY

The term Internet economy refers to various types of quantifiable economic impacts of the Internet,. OECD adopted several general approaches to measure the scatterness of the Internet Economy. These involved measuring the: i) direct impact; ii) dynamic impact; and iii) indirect impact. The first approach (the direct impact) is the most conservative and

relies mainly on official data. It groups studies that measure the size of the Internet economy expressed as a part of GDP.. The second approach looks at the dynamic impact that the Internet might have on all industries and hence on the rates of productivity growth and eventually GDP growth. This approach includes the effects of Internet on productivity and profitability of firms and hence evaluate the contribution of the Internet to the net growth of the economy as measured by official statistics. The third approach looks at, the indirect impact of the Internet. Studies within this approach examine the effects of the Internet on economic phenomena like consumer surplus or how the Internet contributes to social welfare gains.

4. DIGITAL TECHNOLOGIES

World Development Report 2016 Digital Dividends , looks at what countries can do to get more out of the internet and other digital technologies. Although it looks ahead to a world in which the internet is universally available and affordable, the analysis largely takes the technology for granted. But technological change is continuous and frequently disruptive. This spotlight examines a range of technologies, identified in the technology forecasting literature that promise to be far-reaching in their impact on development. Like the internet, they are likely to be encountered first in the developed world, but will spread quickly to the developing world, where their impact may be even greater.

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 (Gbit/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

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.⁶ Algorithms are now better able to recognize language and images, for example, thanks to the availability of huge torrents of data from interconnected phones, tablets, and computers. The benefits of AI are beginning to be seen in education, with personalized learning; in health, with deep diagnostics; in agriculture, with crop planning, precision farming, and optimized resource application; and in banking and insurance, in areas like customer service, risk management, and compliance. 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- Roughly 750 000 industrial robots were estimated operational in OECD countries in 2014, constituting more than 80% of world stocks. 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%. Rubber and plastics have lower concentration at less than 10% and metal products (5%).The take-up of robots is expected to rise as a function of their falling costs and growing intelligence, including in developing countries. China is the world’s biggest importer of industrial robots. Guangdong province recently announced a program to automate 80 percent of its factories by 2020, by substituting human labor with robots.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. Rwanda plans to be home to the world’s first drone airport, or “droneport,” to facilitate the delivery of medical and emergency supplies, quickly and costeffectively, across geographical barriers

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. Globally, there has been a rise in spaces where people can gather to build and learn with electronics, software, and digital fabrication

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.¹⁸ 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.

The biennial OECD Digital Economy Outlook examines and documents evolutions and emerging opportunities and challenges in the digital economy. It highlights how OECD countries and partner economies are taking advantage of information and communication technologies (ICTs) and the Internet to meet their public policy objectives. European Union consider digital economy as “the single most important driver of innovation, competitiveness and growth in the world

The World Development Report 2016 Digital Dividends highlights many instances of how e-commerce is boosting the employment opportunities of those who may have been excluded from the global market place. According to the report, the internet enables many small firms to participate in global trade, thus leading to more inclusion.

It says that digital technologies have spread rapidly in much of the world. Digital dividends—that is, the broader development benefits from using these technologies—have lagged behind. To get the most out of the digital revolution, countries also need to work on the “analog complements”—by strengthening regulations that ensure competition among businesses, by adapting workers’ skills to the demands of the new economy, and by ensuring that institutions are accountable. The report The Future of Digital Economy and Society examines Americans’ use of – and attitudes toward – the shared, collaborative and on-demand digital economy.

5. 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.

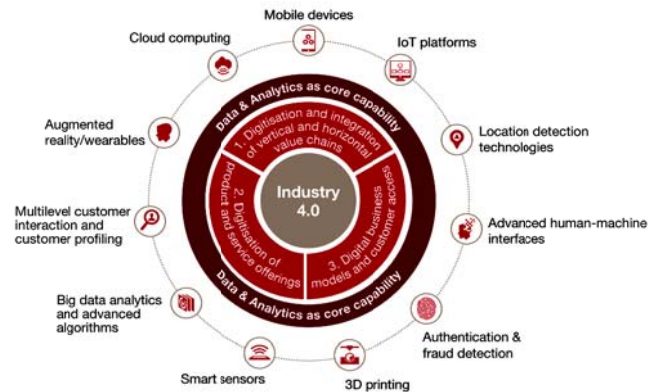


Figure 1: Industry 4.0 framework and contributing digital technologies

Source: Industry 4.0: Building the digital enterprise

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 Industry 4.0 digitises and integrates processes vertically across the entire organisation, from product development and purchasing, through manufacturing, logistics and service. All data about operations processes, process efficiency and quality management, as well as operations planning are available real-time, supported by augmented reality and optimised in an integrated network. Horizontal integration stretches beyond the internal operations from suppliers to customers and all key value chain partners. It includes technologies from track and trace devices to real-time integrated planning with execution. 2) Digitisation of product and service offerings

Digitisation of products includes the expansion of existing products, e.g. by adding smart sensors or communication devices that can be used with data analytics tools, as well as the creation of new digitised products which focus on completely integrated solutions. By integrating new methods of data collection and analysis, companies are able to generate data on product use and refine products to meet the increasing needs of end-customers. 3) Digital business models and customer access

Leading industrial companies also expand their offering by providing disruptive digital solutions such as complete, data-driven services and integrated platform solutions. Disruptive digital business models are often focused on generating additional digital revenues and optimising customer interaction and access. Digital products and services frequently look to serve customers with complete solutions in a distinct digital ecosystem.

The aim of the World Economic Forum’s System Initiative on Shaping the Future of Digital Economy and Society is to cultivate a shared, trusted digital environment that is a driver of inclusion, economic development and social progress. The System Initiative aims to create networks that enable and

encourage action to promote the long-term health and stability of digitally enabled economies and societies through: understanding the shift through leading-edge intelligence; collectively solving new issues via improved governance and policy-making in a digitized society; and partnering to rapidly scale successes by cultivating an online environment of trust and increasing access and adoption

Fourth Industrial Revolution is going to have a massive impact on the economy as seen by , rise of the sharing economy, blockchain 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).

Blockchain 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. Bitcoin and other digital currencies are some of the most well-known examples of applications of blockchain technology.

6. DIGITAL TRANSITIONS

The transition of traditional sectors to the digital economy is taking place at rapid pace, modifying established business models and generating new demands on innovation.

- Networks and platforms are becoming ever more important and many manufacturing companies are trying to establish their own platforms;

- Innovation in a number of sectors increasingly requires combining different competencies as digital elements are added to traditional products as exemplified well by car manufacturing.

- Digital innovation has ambiguous impact on competition, as it tends to give rise both to active start-up creation connected to product innovation and low entry barriers, and to “winner-take-all” market structures due to economies of scale and network effects.

The transition towards a digital economy may require a different approach altogether to take into account fundamental changes that may challenge countries’ competitiveness within a short period of time. Issues range from reviewing what types of policy support are needed to create vibrant innovation ecosystems etc.

Source: Workshop: “Innovation and the digital economy: What role for innovation policies?” 14 June 2017, Paris, OECD Headquarters

There are many examples of traditional companies transforming to succeed in the digital. Vehicle manufacturers that offer telematics solutions to pinpoint and communicate

maintenance requirements, such as Daimler Trucks North America and its Detroit Connect Virtual Technician, which provides remote diagnostic service for select trucks, also illustrate the digital transformation needed to compete in the digital economy.

China has one of the most active digital-investment and start-up ecosystems in the world, according discussion paper from the McKinsey Global Institute (MGI), China’s digital economy: A leading global force. China is in the top three in the world for venture-capital investment in key types of digital technology, including virtual reality, autonomous vehicles, 3-D printing, robotics, drones, and artificial intelligence (AI). China is the world’s largest e-commerce market, accounting for more than 40 percent of the value of worldwide e-commerce transactions, up from less than 1 percent about a decade ago.

China’s three Internet giants are building a rich digital ecosystem that is now spreading beyond them. Baidu, Alibaba, and Tencent, collectively known as BAT, have been building dominant positions in the digital world by taking out inefficient, fragmented, and low-quality offline markets while driving technical performance such as computing efficiency to set new world-class standards.

This discussion paper is a preview of a major MGI report on digital in China that will explore how digital disruption will enable companies to boost their efficiency, boost revenue, and optimize cost, and how three types of digital disruption—dematerialization, dis-intermediation and disaggregation—can help to restructure value chains, and increase the speed of the disruption.

7. NETWORK

Customers, customer-centric marketers declare, are king. Businesses consequently ignore customer behaviors at their own risk. But the power and potential of network effects suggests that seeing customers as royalty may prove a poor idea and an even worse investment.

Successful platform companies and competitors see their customers and clients as assets worthy of innovative investment.. In Uber’s business model, for example, smart apps make both the company’s customers and drivers more valuable to both Uber and each other. In fact, the ability to creatively invest in one’s customers as a result of digital networks is central to new research, *Rethinking Networks: Exploring Strategies for Making Users More Valuable*.

As platform companies like Google, Apple, Facebook, Uber, Amazon, Airbnb, and LinkedIn relentlessly disrupt — and redefine — mainstream industries, the network effects is their “secret sauce” for success. Network effects increasingly determine innovation opportunity, value creation, and growth in digital markets. This holds true for Netflix, Twitter, Github and Alibaba — as well as the so-called Internet of Things —

that all rely heavily upon network effects as a competitive edge and innovation

Network effects turn users into assets. Enabling network effects empowers users/customers to both directly and indirectly create new value. Network effects are special economic phenomena because they make their contributors more valuable to everyone in and on the network.

This same design sensibility holds true for browsing Amazon and Netflix recommendations; hailing — or driving — an Uber; seeking — or offering — Airbnb accommodation; and utilizing smartphone apps to get something done. The more users participate, and the more innovatively they engage, the more value — and valuable data and experiences — can quickly be generated. In turn, the more value created, the more users — and innovative uses — materialize..

8. VARIOUS STUDIES ON DIGITAL ECONOMY

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 15. Rouse 2016: Digital Economy
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- (Source: *Defining, Conceptualising and Measuring the Digital Economy* .Rumana Bukht & Richard Heeks 2017)

9. CONCLUSION

Digital economy is a multifaceted and dynamic in nature and due to the transformational power of digital technologies. The digital economy is unevenly distributed. The digital economy is growing faster than overall economies. The digital economy contributes significantly to employment. Data as a source of value is a key feature of the digital economy. Data are collected from several market players and activities. The increasing capacity to collect, store and treat massive flows of data has led to the concept of "big data" that could generate value either in private (marketing) or public (government) activities. Network effects are pervasive in the digital economy. They have allowed private value creation especially through so-called multi-sided business. Emerging digital economy has the potential to generate new scientific research and breakthroughs, fueling job opportunities, economic growth, and improving how people live their lives.

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