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**Center for Analysis of Economic  
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# **DIGITAL ECONOMY**

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The book examines the role of digitalization in economic development and presents the current theoretical foundations in this field. Digital mega-trends, the essentials of digital economy, important different aspects of traditional economy and digital economy, estimation of digital economy, digital society building, socio-economic aspects of digitalization, digital security, etc. theoretical-practical aspects are presented. Information is provided about individual components of the infrastructure of the digital economy and the degree to which digitalization covers various sectors of the economy. E-commerce, which is one of the driving factors in the development of the digital economy, and its important factors are also reflected in the book. The book also reviews digital transformation process in Azerbaijan.

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**NOW WE WILL BE KNOWN ALL OVER  
THE WORLD NOT ONLY AS A COUNTRY  
WITH OIL AND GAS RESERVES, BUT ALSO  
AS A COUNTRY WITH HIGH-LEVEL  
SCIENTIFIC POTENTIAL APPLYING OF  
INFORMATION-COMMUNICATION  
TECHNOLOGIES IN THE FUTURE.**

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**ILHAM ALIYEV,  
President of the Republic of Azerbaijan**

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## **INTRODUCTION: FUNDAMENTALS OF DIGITAL TRANSFORMATION**

Considering the current speed of digital transformation, we understand how bold steps the co-authors took by writing this "Digital Economy" book. When the ancient Greek philosopher Heraclitus said that "a man cannot step into the same river twice", he based on the fact that both the river and the person are under change. Of course, the rate of change has increased tremendously in the modern era compared to the time of Heraclitus. During the preparation of this book, the co-authors were faced with pressures such as the speed of change, as the processing of information lags behind its flow. For example, a recent Forrester survey of 4,036 senior executives found that 70% of data decision makers are collecting data faster than they can analyse and use it, but 67% constantly need more data. Nevertheless, the group of co-authors could complete this book in about a year. Because they had a deep belief in the benefits of "Digital Economy" book in education and for state, society and business world.

The Fourth Industrial Revolution has three main technologies: bio, physical and digital. This book talks about economic development based on digital technologies. Digital economy refers to a wide range of economic activities that use digitized information and knowledge as key factors of production. Sometimes the digital economy is called as "web economy", "new economy" or "internet economy".

In all three directions of digital transformation - digital government, digital economy and digital society, the most important issue is the digital readiness of a person. Professor Tatyana Chernigovskaya calls the new human type created by digital reality "Homo Confusus" ("Человек растерянный" in Russian) - "confused man". "Homo Confusus" does not fully understand how to live in the new reality. For example, earlier people could be satisfied with choosing once specialization in their life, but now there is a demand to change and improve their majors by studying and learning throughout their life. In this regard, digital



transformation can be confusing and exhausting for both leaders and employees. At the same time, emerging digital technologies are reshaping everything from supply chains and manufacturing to sales and distribution, as companies scramble to create a differentiated customer experience amid fierce competition. All these cause to complex changes.

The complementarity of digital transformation and human values is one of the main issues. With the creation of cyborgs - cybernetic organisms embodying a machine-human hybrid, the levels of IQ (intelligence quotient), EQ (emotionality quotient) and LQ (learning quotient), as well as cultures and worldviews of people should be optimally balanced. Because a chain is only as strong as its weakest link. As a result of the Meiji reforms, Japan was able to build the economy and state on Western models, but preserved its national culture. Ziya Gokalp wrote that the Japanese entered the Western culture under the condition of preserving their religion and nationality. The unprecedented rapid development of China and South Korea was made possible by the synthesis of human achievements and national culture.

According to the announcement of the Davos Economic Forum, the world can create more data in the next three years compared to the last 30 years. Information created by machines, provides up to 40% of Internet traffic. If we take into account that the number of devices connected to the network in the world will reach 125 billion in 2030, we can get an idea of the size of data generated. The growth of data presents new challenges related to its collection, transmission, processing, use and analysis. In this direction, the business must first create a data strategy and appropriate skills. In business, the Chief Data Officer (Chief Data Officer) should cope with the task as a person who knows data analytics and possesses a vision.

The second is the institutional approach: National and global data regulations need to be modernized. Data for the Digital Economy Partnership Agreement (DEPA) proposed by Singapore, Chile and New Zealand, the General Data Protection Regulations (GDPR) of the European Union and the General Purpose Initiative of the World Economic Forum Pioneering initiatives such as the Data for Common Purpose Initiative (DCPI) exemplify the institutional approach. The

adopted global agreement on the Ethics of Artificial Intelligence supported by UNESCO is the right institutional approach towards the healthy development of this field. Third, all stakeholders in the data ecosystem must promote a data-driven culture.

The road map of digital transformation for business was defined in a study by Harvard Business School as follows:

1. As digital transformation shakes up the entire value chain and happens at rapid speed, emotional solutions must be found for employers and employees;
2. Customer-centric narratives should be formed and activities should be adapted accordingly;
3. Capacity building and development of a data-driven culture is required;
4. It is necessary to be able to properly manage the dynamics brought by the data;
5. Inclusive and flexible design is important for problem solving;
6. Perspectives of external vision and cooperation should be strengthened, even competing companies can cooperate to use the service of the same suppliers;
7. Business ethics, compliance with regulatory requirements and proactive approach in management should be preferred.

One of the main advantages brought by the digital transformation is that social affairs have entered a new stage. French scientists Yann Algan and Pierre Cahuc calculated the dependence of economic growth on people's trust in each other and society. It became clear that Sweden is in the first place in the world according to the level of trust, and if there was trust at this level, the per capita income could increase by 7 percent in England, 9 percent in Germany, and 69 percent in Russia.

According to the Coase theorem, mistrust in society increases transaction costs and drags the economy back. Mancur Olson also says that confidence plays a big role in the growth of the Japanese and German economies. Trust and confidence are a resource for development in Azerbaijan as well as in all countries. Digital transformation builds trust,

and even people who don't trust each other and institutions enough believe in digital solutions. That is, thanks to digitalization, mutual trust is strengthened in society as a whole and an atmosphere of confidence is formed.

One of the areas where digitization left a track record is the financial and banking sector. Starting from the 7th century of our era, the Chinese began to use paper money, and in the 13th century, Genghis Khan's grandson, Kublai Khan, first valued paper money not with any commodity, but with a state guarantee. Thus, the concept of money in the sense we now accept was born. According to Eswar Prasad, this time the money revolution is being driven by private sector innovation, and the first spark came from bitcoin in 2009: digital currency does not need a third party such as a government, bank or payment processor. In his book *The Future of Money*, Prasad notes the monetary split between the state and the private sector, predicting that state-issued money will prevail as a means of value, while private currencies will prevail as means of payment. Oleg Itskhoki, a professor at the University of California in Los Angeles, does not consider cryptocurrencies to be very suitable for performing the basic functions of money - as a means of value, payment and collection. Itskhoki explains his opinion that cryptocurrencies are extremely volatile. The words of Prasad and Itskhokin can be "reconciled" so that the money issued by the state fulfils the functions of equivalent of value, means of payment and collection, and cryptocurrencies can be considered more as assets.

In fact, the government is reacting to the crypto revolution by creating a digital version of its issued money and trying to maintain its dominance. For example, China has launched a digital yuan project. In this country, the digital yuan is viewed as a means of protecting currency sovereignty. Digital currencies can change the fundamentals of financing, as Amazon.com Inc. changed retail trade and Uber Technologies Inc. changed the taxi system. In 2021, "The Wall Street Journal" wrote that the US Treasury Secretary Janet Yellen and the head of the Federal Reserve System, Jerome Powell, expressed the possibility of a digital dollar. According to the Bank of International Settlements, the dollar has an 88 percent share in world currency auctions, surpassing the Chinese yuan

with a 4 percent share and other currencies. But the digital level competition of currencies representing these two giant economies can open new perspectives. The US dollar was able to ensure its hundred-year currency dominance in the 20s of the last century. At that time, the United States had surpassed Great Britain, the world's largest economy, in terms of GDP for 30 years. In the near future, China will overtake the US in terms of GDP (already surpassed by purchasing power parity). Thus, there is a threat to the dominance of the dollar in the foreign exchange market. The race to digitize currencies is the new technological weapon in the "currency wars". Even in 2021, El Salvador became the first country in the world to accept bitcoin as a legal tender along with the US dollar, despite local protests. In El Salvador, people even download a government-created digital wallet app to own \$30 worth of bitcoin.

As oil resources are exhausted, the main commodity in the world, including in Azerbaijan, is data and information. The collection, storage, protection, use and transfer of data requires a new approach. In accordance with world trends Azerbaijan forms policy in creation of legislation on privacy protection and data use, regulation of content and digital trade, protection of intellectual property rights, provision of cyber security and cyber diplomacy in conformity with the concept of digital transformation. The most important thing is to maintain a balance between privacy and innovation. Currently, a unified approach to digital commerce and international law is being developed. Already around the world, "non-tariff" barriers are being implemented by blocking data flows and implementing data localization policies, and in this way, states protect their independence. Even digital protectionism turns into "Artificial Intelligence Nationalism" and states not only protect their national data, but also build their own "data economy" by processing their data. After the Edward Snowden incident in 2013, states began to understand the importance of the "data economy" more deeply. Let's recall just one fact that it was predicted that cybercrimes will cause 6 trillion dollars of damage to the world economy by 2021. Cyber intrusions threaten not only business operations and supply chains, but also financial and communications infrastructure, national security, privacy, trade and commerce. The costs of cyber espionage and cyber

warfare are difficult to estimate, but these practices are also widespread.

Countries and companies that maintain privacy in the field of artificial intelligence will succeed and be more competitive. In the current information age, having access to data creates a "wise cycle". More data allows companies to build better applications and technologies, which increases their profitability, and in turn, companies collect and use more data in this way. Therefore, whoever obtains and controls the data will also control the "hegemony".

Robert Kaplan wrote in his work "The Revenge of Geography": "We thought that globalization removed the question of "who can compel whom?" but this question became even more important now". We also agree with Kaplan that the importance of geography in the era of globalization cannot be forgotten, because the cyber environment itself depends on the geographical infrastructure. For example, 99 percent of the information we exchange goes through submarine cables. So there is a connection between cyberspace and geography. Azerkosmos, which manages artificial satellites, also has a geographical connection and the Main Earth Satellite Management Center operates. It is no coincidence that China regards cyberspace as an extension of its sovereign territory and maintains national security. In the European Union, data protection is considered a privacy issue and seen as a human right. Values and cultural context are also different in this matter. A data geopolitics is taking shape in the world.

The rapid evolution of technologies is reshaping the dynamics between governments and private actors. Governments investing more in technologies such as big data, 5G, artificial intelligence and quantum computing already have strategic advantages over other countries. It is estimated that 5G will create \$13 trillion in value and create 22 million jobs by 2035, and the global artificial intelligence market will reach \$15 trillion by 2030. These figures prompt governments to enter the race for technological leadership. Governments use all means to acquire intellectual property related to advanced technologies and projects. Let's admit that, on the one hand, Armenia's occupation policy against Azerbaijan slowed down the development of Karabakh and Eastern Zangezur economic regions, but on the other hand, it accelerated the

introduction of new technologies in our military-industrial complex, space industry and defence system. But the competition is getting fiercer. The USA, China, South Korea and Israel are the countries that invest more in these technologies. These countries clearly aim to be drivers of new technologies, implement their standards and benefit more from their companies' technological superiority. If we do not master these technologies in time, we will not be able to manage the large amount of data we produce. Also, taking into account that we are a small country in terms of territory and population, and our ability to produce data is limited, then we should pursue a policy as to turn Azerbaijan into a regional data processing centre.

If earlier oil and gas giants were in the leading positions in world geopolitics and geo-economy, now technology giants are geopolitical players and have actually become global stakeholders. Thundermark Capital's AI Research Rankings 2020 shows that private tech giants are investing more in AI research than government think tanks.

ICT investments generate more returns than other capital investments. Huawei (2017) in its Global Internet Connectivity Index 2017 report shows that every US\$1 additional investment in ICT infrastructure can generate US\$3 in GDP and US\$3.70 in additional revenue after 2020, and the potential revenue could increase to US\$5 in 2025. Azerbaijan should consider this factor in its digital transformation vision. Investment in the ICT sector can be implemented in various forms. First, the government can use grants and subsidies to promote technology diffusion and bridge the technology gap between platforms and SMEs. Rather than waiting for the market to achieve fair access to technologies such as artificial intelligence, the state has the option of funding programs that directly affect small and medium-sized firms, for example through tax relief or other instruments. Although such an approach would increase public debt in the short term, these costs would be offset by increased productivity accompanied by a more balanced distribution of economic power. Second, we need to work toward a more flexible, multilateral model of innovation so that concerns about market access and representation are addressed without limiting the pace of technological change. In this regard, the goal should be to reduce the

tension between winners and losers in the new value chains of the platform economy. Third, it is time to define the appropriate field for "digital protectionism". Just as some countries use trade tariffs to support start-up manufacturing, this practice can be applied to the adoption of digital technologies and policy easing of tariffs to foster local innovation ecosystems.

The pandemic, which reduced the pace of life, not only slowed down digital transformation, but also proved its importance once again. Even Moore's Law, which predicts that the importance of transistors in microchips will double every two years, does not "withstand" the speed of digital transformation. Quantum physics and the Heisenberg principle of non-vibration create a completely new reality. A quantum transformation has grown within the digital transformation. The basic unit of a quantum computer is the quantum bit (or cubit for short). While every binary bit used in today's digital computers can be 0 or 1, cubits can be both 0 and 1 (or a combination of both) at the same time. This phenomenon is called superposition. Quantum entanglement is a special relationship between pairs or groups of quantum elements. Increasing the number of cubits increases the processing speed of calculations. A total of 18 quadrillion bits of conventional memory are required to create a model of a 54-cubit quantum computer. Building a 100-cubit quantum computer requires more bits than the number of atoms on our planet. A 280 cubit computer requires more bits than the known number of atoms in the galaxy. Quantum computers have the potential to perform much better than digital computers based on the laws of classical physics. Nobel laureate physicist William Phillips has compared the jump from manual calculation to digital computer with quantum leap from today's technology. Until recently, quantum supremacy or so-called quantum "law" was just a theory. But in 2019, Google solved a particular calculation task in 200 seconds using a quantum computer. The company stated that the most powerful digital computer of that time would have completed the same task for 10,000 years. Quantum technologies are changing our whole life at an incredible speed.

In the age of speed, humanity is emotionally balancing between anxiety and indifference towards the development of technologies. Elon

Musk and a group of artificial intelligence experts and industry leaders called in 2023 that powerful artificial intelligence systems should be developed only after they are sure their effects will be positive and risks manageable. Israeli intellectual Yuval Noy Harari advocates balancing the development speed of artificial intelligence and human capital.

For now, in this book, we focus on the digital economy. The first part of the book examines the role of digitalization in economic development and discusses the current theoretical foundations in this field. Theoretically, the role of digitalization in the development of countries, including Azerbaijan, and the dynamics in this field are analyzed at the macro level. In the corresponding part, the research on future prospects is also presented identifying the innovative global trends related to digitalization. The world experience of digital development concepts, which are currently widely discussed at the global level, is explored in the book and explored at a macro level. In addition to digital mega-trends, the nature of the digital economy, sectoral (agriculture, education, finance, etc.) meso trends, the book also includes fundamental differences between the digital economy and the Internet economy, traditional economy and digital economy paradigms, and measurement issues of the digital economy, building a digital society, socio-economic aspects of digitalization, the digital age gap, a view of digitalization from the perspective of "Sustainable Development Goals - 2030", theoretical and practical comments are given regarding the national-spiritual aspects of digitalization in the conditions of the Fourth Industrial Revolution.

The second part of the book contains information about individual components of the digital economy infrastructure. Methods and risks of ensuring cyber security in the digital economy are classified. It was explained in which directions data analytics and software are used. At the same time, information on the current state of personnel potential in the digital economy and the most in-demand professions, as well as world experience related to the existing regulatory and legal framework was studied. Information on patenting innovative projects and international regulations in this field is also reflected in the last paragraph of the section.



In the third section, "Sectoral view of the digital economy", the extent to which digitalization covers individual sectors of the economy and the main trends in this area are discussed. Among the most digitized sectors, FinTech and its sub-components include electronic wallets, crowdfunding from alternative financial instruments, cryptocurrency and blockchain technology, as well as robot advisors that play the role of portfolio managers in investments. In this section, as another important direction, information about "RegTech" that digitize legal and regulatory functions is also presented. Also in the section, new educational trends and "EdTech", "InsurTech" which creates advanced insurance systems, "AgroTech" which organizes smart agriculture systems and other sectors were mentioned.

In the fourth section of the book, information on the history and current state of electronic commerce, which is one of the driving factors in the development of the digital economy, is presented. In the following paragraphs, practical examples of modern trends in electronic commerce and their areas of application are reflected. At the end of the section, the development directions of e-commerce and suggestions for solving the existing problems in this field were given.

In the fifth section called "Digital transformation", the importance, necessity, main features and advantages of digital transformation, which is the main demand of the modern era are discussed. In the following paragraphs, the role of digital transformation in the effectiveness of the government is analysed, and the experiences of digital transformation in different countries of the world are given as examples. At the end of the chapter, attention is focused on the economic efficiency of digitalization of public services.

The sixth section of the book analysed and evaluated the management and institutional frameworks for digital government in Azerbaijan. The formation of electronic government in Azerbaijan began with the "National Strategy on Information and Communication Technologies for the Development of the Republic of Azerbaijan" signed by national leader Heydar Aliyev in 2003. The work carried out in the field of application of electronic government became more extensive with the adoption of the

"State Program for the Development of Information Technologies in the Republic of Azerbaijan for 2005-2008" (Electronic Azerbaijan) that was developed and continued in accordance with the second "Electronic Azerbaijan" State Program covering the years of 2010-2012 and the "Action Program on the Formation of Electronic Government in the Republic of Azerbaijan". "Strategic Roadmap for the Development of Telecommunications and Information Technologies in the Republic of Azerbaijan" stated that since ICT had the potential to change a number of aspects of business and trade operations, the government should use ICT to regulate these functions, support those services and increase their efficiency and get additional profit by using the power of "digital transition plan" prepared within the framework of strategic road maps. According to the "State Program on the Expansion of Digital Payments in the Republic of Azerbaijan in 2018-2020", the expansion of the application and use of digital payments will lead to the reduction of cash-related expenses and the operational costs of banks and enterprises by clarifying economic cycles, which, in turn, will lead to the expansion of the tax base, as well as the scope of financial services for the population and enterprises, the lending and investment opportunities of the banking sector will stimulate its strengthening and ultimately economic growth. The creation of a public legal entity "Analysis and Coordination Center of the Fourth Industrial Revolution" under the Ministry of Economy is aimed at strengthening the position of Azerbaijan in the Fourth Industrial Revolution, which dictates the trends in the global economy and changes the rules of competition and aims to ensure its place among the leading countries in this field. Cooperation and coordination with international organizations operating in the field of the Fourth Industrial Revolution, as well as the analysis and coordination of calls, initiatives, strategies and projects on the digital economy are also important for economic growth. The development of broadband internet network, "Government Cloud" (G-Cloud), "Big Data", initiatives such as "smart city" and "smart village" in Karabakh, Eastern Zangezur are also part of the digital transformation. According to the results of the current year survey of the UN Commission for Asia and the Pacific (UNESCAP) "Assessment of readiness for cross-border paperless trade" project in 2021, Azerbaijan achieved a 5 percent

increase compared to 2019, in general 86 percent compared to neighbouring countries (Russia 84.95 percent, Georgia 82.8 percent, Iran 77.4 percent, Armenia 62.4 percent, Turkey 86 percent) and ranked 1st among CIS countries. The average indicator for the whole world is 64.95 percent, and for developed countries it is 81.9 percent. In Azerbaijan, the strategy of electronicization and digitalization has been implemented in various directions: Azerbaijan Digital Trade Hub, State Control Information System, Electronic Agricultural Information System, electronic procurement platform for state procurement, obtaining state statistical data, e-document circulation system, electronic court system, electronic health service, electronic education, electronic social services, instant payments system, electronic cadastre of property and land, etc. projects were implemented. In order to monitor and evaluate the state programs, strategic road maps, action plans, economic promotion projects, as well as the activities carried out in industrial parks, neighbourhoods and agricultural parks, e-portal of monitoring.az was established by the Center for Analysis of Economic Reforms and Communication was created. At the same time, in accordance with the principles of electronic and open government, the process of electronicization continues to improve local governance in local executive authorities. The process, which was initially started with the electronic municipal system, was launched in May 2021 by the Electronic Government Development Center of the State Agency for Service to Citizens and Social Innovations under the President of the Republic of Azerbaijan continued with the initial version of the "Digital executive power" portal. The Decree of President Ilham Aliyev "On improving management in the field of digital transformation" dated April 27, 2021 shows that the digital transformation of the economy and society has become one of the priority issues facing the Republic of Azerbaijan in recent years.

We hope that the book "Digital economy" will be useful not only as a textbook in high schools, but also for decision-makers, researchers and those who want to study this field!

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