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INDUSTRIAL REVOLUTION 4.0: A NEW PARADIGM FOR ECONOMIC GROWTH

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Abstract

Industry 4.0 is a political, economic and social challenge for the whole world, whose goal is to absorb digital innovations in products, processes and business models. Many developed countries in Europe, America and Asia have included the Industry 4.0 concept in their strategic development programs for the coming decades. Business leaders and global manufacturers accept digital challenges and opportunities as a conceptual leap of new realities generated by technical and scientific progress. At the same time, the criteria for evaluating the performance of transformations in Industry 4.0 are still not enough studied, and the structured and systemic implementation of these technologies in national economies of many countries is not fully finalized. Thus, in this study, the authors examine how European economies have joined the Industry 4.0 Strategy and implement in practice its tools, recording performance in various fields of activity. The second part of the research analyzes the degree of readiness of the Republic of Moldova to accept and address the challenges of the digital age in industry and agriculture in the context of sustainable development. Statistical reports and international and national policy documents on the recognition and acceptance of the notions of Industry 4.0 and the digital economy served as a basis for research to define a new stage of society's development.

***Keywords**: Industry 4.0, informational technologies, artificial intelligence, digital economy*

1. Introduction

In the last thirty years, humanity has gone through many world crises. None of them has changed our existence so deeply. The transportation and manufacture chains are being destroyed as a result of the coronavirus pandemic, which is constraining states to reclaim borders and restructure important public institutions, and universities are moving towards distance learning. Everything that happens in the modern world is not a step in the abyss, but a path to a new reality, based on the revolution in IT and the achievements of Industry 4.0.

Thousands of companies are moving their employees to on-line jobs. The outside office working has become a reality for millions of workers around the world. This forced global experiment will inevitably lead to a radical reform of the labor market and, consequently, to the emergence of new social challenges.

Industry 4.0 is a political, economic and social challenge for the whole world, which aims to absorb digital innovations in products, processes and business models. Many developed countries in Europe, America and Asia have included the concept of Industry 4.0 in their strategic development programs for the coming decades: "*Program 4.0",* implemented in German industry; in France and Italy – "*Factory of the Future"*; "*Society 5.0"*- to solve production and social problems in Japan; in the UK – "*Catapult"*; in the United States – "*Smart Manufacturing"*, in China –"*Made in China – 2025"*; Russia has also set ambitious tasks in the field of information technology. Companies in Europe, the United States and Asia have already entered the race to adopt and use elements of Industry 4.0 in their work, seeing the digital economy as basis for future prosperity [6].

Starting from the ancient world, the economy climbs several stages of development, and today it reaches the fourth stage, which we can call digital, for the simple reason that it is based on information processing and information technologies. Namely, they become suitable for use in traditional spheres, which, as a result, acquire new qualities and advantages.

The development of internet technologies, communication channels and digital platforms has driven the emergence of public information systems and global industrial networks beyond the particular boundaries of enterprises. By interacting, these systems and networks have a transformational impact on all sectors of modern economy, leading to a new era of industrial automation, the fourth industrial revolution.

2. Degree of investigation of the problem currently, and purpose of research

Like any other modern concept, the digital economy does not have a generally accepted definition. There is a whole range of definitions. Initially, the new term "*digital economy"*, designed to characterize trends in the global economy, was proposed in 1995 by Canadian Donald TAPSCOTT, a specialist in business and consulting [14, p. 8]. In his works, TAPSCOTT describes how people can and should change their lifestyle under the influence of information and communication technologies, but also emphasizes the relationships between users, in particular, the possibilities of networking for people from different geographical areas and spheres of activity, etc. Namely, the avalanche growth of information relations reinforces the new economy or Industry 4.0.

The term Industry 4.0 was introduced in 2011, as part of the German initiative, and is based on a digital revolution. World-renowned economist Klaus SCHWAB, Founder and Executive Chairman of the World Economic Forum, explains: "We have the opportunity to shape the fourth industrial revolution, which will fundamentally change the way we live and work" [10, p. 5]. Its main features are "ubiquitous": the Internet, miniature production devices (which are becoming cheaper), artificial intelligence and digital technologies based on hardware and software, as well as electronic networks that are no longer innovations, but every year, go beyond the third industrial revolution becoming more sophisticated and integrated, leading to the transformation of society and global economy.

Professors Eric BRINJOLFSSON and Andrew MCAFEE from the Massachusetts Institute of Technology called this period "the second century of the machine", claiming that "the world is on the brink of an epidemic-like explosion, in which the effects of digital technologies will

manifest themselves “throughout their beauty” in automating and creating “unprecedented things” [2, p. 33].

Some experts believe that the “digital economy” is a separate, specific field of activity that can exist on its own, can process data - this “digital” information - and brings profit, being self-sufficient. The American specialist Nicolas NEGROPONTE (1995) [7, p. 17] suggested that this is an economy that is moving from processing atoms to processing bits, i.e. from the material world to the virtual world.

Most experts share this interpretation of the notion of digital economy. This is valuable because we do not deviate from the specific tasks of humanity, but we see this as a possibility to meet the needs of people.

The cornerstones of Industry 4.0 are: cybernetics, studied by Nobert WIENER (1948) - conceived and formulated as the universal science of administration; cryptography, because the digital economy pays special attention to the issues of information security and truthfulness, which can only be achieved by using cryptography methods and quantum computing.

One of the “pillars” underlying the digital economy is artificial intelligence. Artificial intelligence (AI) technologies include developments such as mechanical training, image and speech recognition. AI is used in information and communication technologies, media industry, retail, health, etc. According to the McKinsey & Company portal, the largest technology companies invest between 20 and 30 billion dollars annually in AI, and the startups - between 6 and 9 billion dollars. At present, AI is best implemented in three areas: telecommunications, machine-building industry and financial services.

IBM experts consider that the basis of Industry 4.0 is the Big Data. Big data is a term applied to data sets the size or type of which exceeds the capacity of traditional relational databases to capture, manage and process low latency data. Big data has one or more of the following characteristics: huge volume, high speed, or great variety. Artificial intelligence (AI) and Internet of Things (IoT) lead to the complexity of data through new forms and data sources. For example, big data comes from sensors, devices, video/audio, networks, files, transactional applications, web and social media - most of the data is generated in real-time and on a very large scale. Big data analysis allows analysts, researchers and business users to make better and faster decisions using data that was previously inaccessible or unusable. Businesses can use advanced analytical techniques such as text analysis, machine learning, predictive analytics, data extraction, statistics, and natural language processing to retrieve new information from previously untapped data sources independently or in combination with existing enterprise data.

We cannot ignore the lock technology (*blockchain*), on the basis of which modern crypto-currencies are built. Blockchain technology is a computer protocol configured in the 1990s. However, its widespread use and success are associated with the spread of cryptocurrencies, the most famous of which is bitcoin.

Thanks to the combination of the increasing computing and analysis power of information system data, the strengthening of connectivity in Europe and the constant evolution of artificial intelligence systems, the potential for using multi-purpose distributed ledger technology is growing exponentially. At the same time, blockchain technology is a code, i.e. a

communication protocol, and a public register in which they are "annotated" with a high degree of transparency and without the possibility of modifying all transactions made between network participants, according to a sequential order. This registration order consists of a set of concatenated "blocks" (parts of the code), using a cryptographic function that tracks each part of the block forming a chain that cannot be modified. These "concatenated blocks" are recorded simultaneously on each of the devices through which the participants of the blockchain connect. Each participant is a chain "link" that contributes to the validation and archiving of the data exchanged.

We will emphasize that blockchain technology is relevant, especially for countries and branches, where the level of trust in banks, governments, contractors, etc. is low, also the technology is attractive thanks to its transparency and degree of protection. Examples include crowding, electronic elections, and new types of intellectual property protection and user identification, smart contracts, which require instant and secure data exchange. There is a step along this path - nano-technologies that work at the level of atoms and molecules and can do real miracles and all sorts of smart technologies: "smart home", "smart neighborhood" and even "smart city". All this is part of the notion of digital economy.

The purpose of this research is to define the concept of Industry 4.0, to study the impact of IT products on the sustainable development of world economies, how to approach this concept in the legislation of the Republic of Moldova, and the ability to assimilate and implement IT technologies in the development and growth strategy of the country.

3. Methods and materials applied

To achieve the objectives of the study the following research methods were used: documentation, comparative analysis, synthesis. The selected research methods made it possible to study and compare national and international legislation and strategies in the field of digitalization of the economy. The studied literature allowed the definition of the concept of Industry 4.0; the situational analysis carried out highlighted the technological potential and the problems faced by the economy of the Republic of Moldova in this field.

To quantify the potential global impact of Industry 4.0, we analyzed the reports of The Boston Consulting Group (Report: *Industry 4.0: The Future of Productivity and Growth in Manufacturing Industries* [15]*),* the opinions and reports of the European Commission in the IT field, international Statistical portals [8]. To analyze the perspectives of economic growth based on IT and the real situation in Moldovan economy we considered the International Data Corporation Report for Moldova 2019 [9], data of the National Bureau of Statistics, National Strategy „Digital Moldova 2020" [12], Reports of enterprises on investments in information technologies. The research is based on statistical and scientific data analysis approach.

4. Results obtained and discussions

According to the Industry 4.0 BCG Report [15] and the Global Digital Operations Study 2018 [4] the prospects for economic growth in the European Union will be determined by the implementation of Industry 4.0 technologies in seven main areas of activity.

1. **Productivity**. In the next five years, Industry 4.0 will be embraced by several multinational companies, which will lead to increased productivity in all production sectors. For example, in Germany, productivity gains from conversion costs, which exclude the cost of materials, will range from 15% to 25%. Taking into account material costs, productivity growth is from 5 to 8 percent. These improvements will vary by industry. Manufacturers of industrial components will achieve some of the largest increases in productivity (from 20 to 30%), and car manufacturers can expect an increase of 10-20% (see Figure 1).

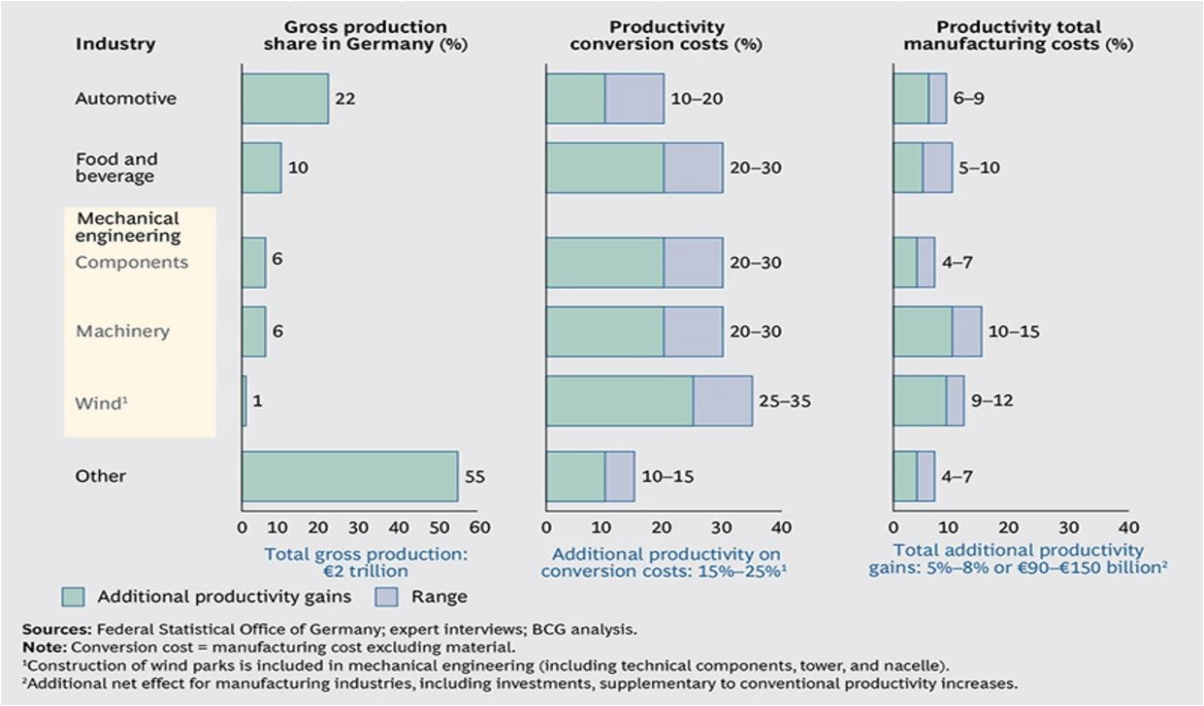

Figure 1. Increase in industrial productivity in Germany as a result of the implementation of Industry 4.0

Source: BCG Report [15]

2. **Increasing income.** Industry 4.0 will also lead to higher revenues. Manufacturers'demand for improved equipment and new data applications, as well as consumer demand for a wider range of increasingly customized products, will lead to further revenue growth of around € 30 billion a year or about 1% of Germany's GDP**.**
3. **Employment**. An analysis of the impact of Industry 4.0 on German production, found that the growth it stimulates would increase employment by 6% over the next ten years (see Figure 2). Demand for employees in the mechanical sector could increase even more - by up to 10% over the same period. However, different skills will be required. In the short term, the trend towards greater automation determines the dismissal of low-skilled workers, who perform simple, repetitive tasks. At the same time, the increasing use of software, connectivity and analytics is increasing the demand for employees with skills in software development and IT technologies, such as mechatronics experts with software skills. This transformation of skills is one of the key challenges.

4. **Investment.** Adapting production processes to incorporate Industry 4.0 will require German manufacturers to invest between one and 1.5 percent of producer revenues over the next ten years. The estimated benefits in Germany illustrate the potential impact of Industry 4.0 on global production. Industry 4.0 will have a direct effect on manufacturers and their workforce, as well as on companies that supply production systems.

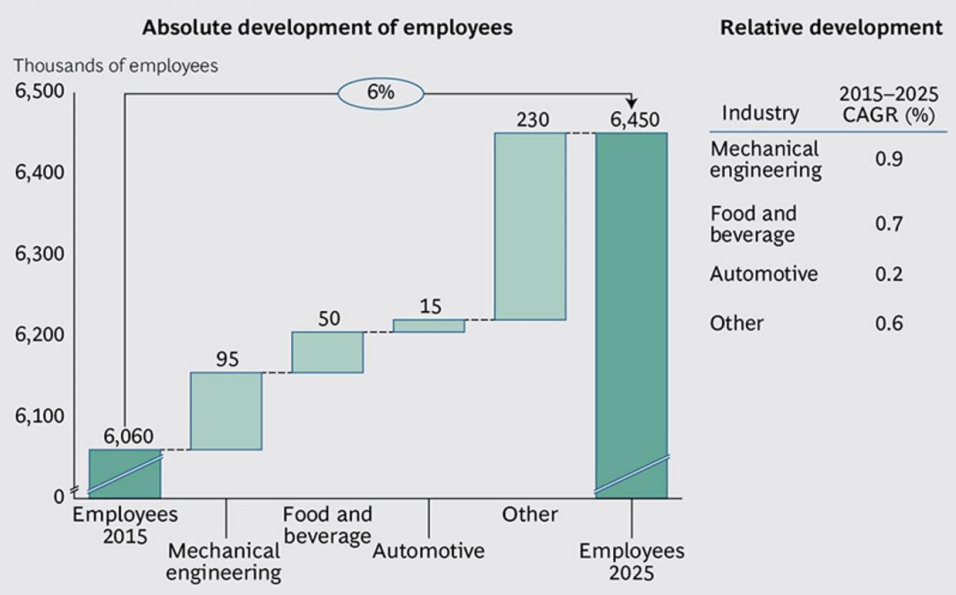

Figure 2. Increase in production employment in Germany as a result of the implementation of Industry 4.0

Source: BCG Report [15]

5. **Producers.** The next wave of production affects the entire value chain of manufacturers, from design to after-sales service. Throughout the value chain, production processes are optimized through integrated IT systems. As a result, fully automated integrated production lines are replacing today's production cells**.**

Industry 4.0 enables a faster response to customer needs than is possible today, improving flexibility, speed, productivity and quality of the production process. It lays the groundwork for the adoption of new business models, production processes and other innovations. This will provide a new level of mass customization, as more manufacturers, investing in industry, also invest in Industry 4.0 technologies to improve and customize their offerings.

Industries and countries will embrace Industry 4.0 at different rates and in different ways. Industries with a high level of product variants, such as the automotive, food and beverage industries, will benefit from a higher degree of flexibility that can generate productivity gains, for example, and industries that require high quality, such as semiconductors and pharmaceuticals, will benefit from improvements based on data analysis, which reduce error rates.

Highly skilled countries will be able to capitalize on a higher degree of automation, combined with an increase in higher labour demand. However, many emerging markets with a young

and technologically intelligent workforce could also create completely new production concepts.

In general, enterprise software is aimed at improving productivity and efficiency, meeting the needs of one or more core processes through single software architecture. Human resources, accounting and sales are frequently targeted functions of such programs. The enterprise software marketplace includes smart applications for enterprise resource planning, customer relationship management, supply chain management, and project and financial portfolio management.

International statistics and forecasts show that enterprises' overall spending on IT and software technologies has increased several times from 2009 to 2019. In 2018, software spending reached $ 391 billion. In the same year, spending on the global information technology market increased to 3.683 billion US dollars, while IT services, the second largest segment in the field of communications services - to 1003 billion US dollars [8].

According to an analysis carried out by the Statista portal, in 2020, it is estimated that IT expenses for enterprise software will amount to approximately 503 billion US dollars worldwide. The software market registered a high growth in recent years, with revenues doubling in the decade between 2009 and 2019. Recent forecasts suggest that this rapid expansion trend will continue in the coming years, with market revenues reaching 556 billion by 2021 (see Figure 3).

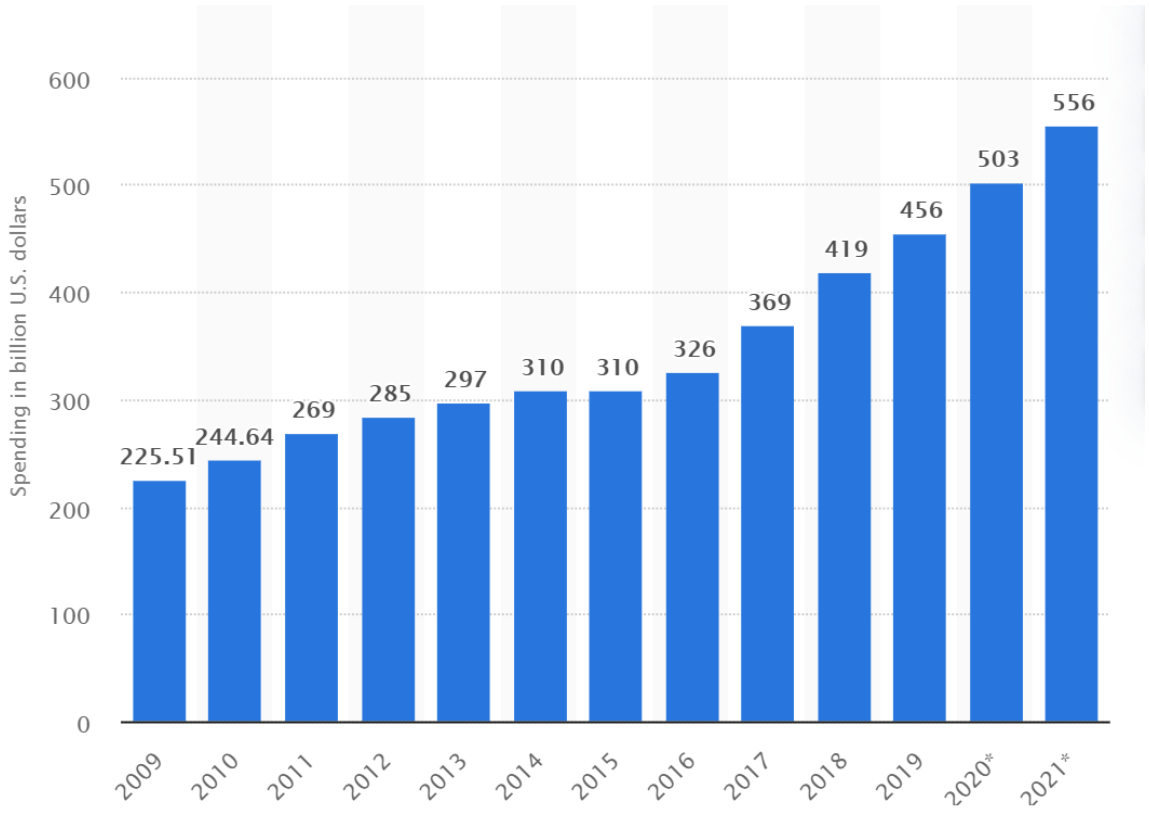

Figure 3. Evolution of global spending on IT and Software (2009-2021)

Source: https://www.statista.com/statistics/203428/total-enterprise-software-revenue-forecast/

With year-on-year growth, often exceeding 10%, the enterprise software market is the fastest growing segment in the IT industry. Enterprise software is aimed at meeting the needs of organizations, addressing in particular the efficiency of their core business processes. In recent years, many enterprise software sub-segments, such as business process management software, enterprise resource planning software, and customer relationship management software, have developed in massive markets.

According to the consulting firm Strategy & Global, German companies invest 40 billion euros annually in industrial internet infrastructure. This is a significant part of European investment in the fourth industrial revolution, which is expected to reach 140 billion euros per year. Out of 278 companies surveyed in Germany, 131 reported that they were already "involved in Industry 4.0" [13].

According to the statistical portal OECD Stats (Organization for Economic Co-operation and Development), in 2017, 87.32% of German companies had websites and used IT resources in business, in France this index was 66.53%, in the US and Great Britain - 83.63%, and in Finland - 96.28% [8].

Analysing the situation regarding the implementation of IT in the economy of the Republic of Moldova, international experts found that given its level of development, our country has an extensive information technology infrastructure. The International Telecommunication Union (ITU) examined the indicators of access and use of IT in 2012, and attested that the situation in our country is better compared to the average in the CIS countries and is close to that of the Central and Eastern European countries, however, IT is not a defining element in the organization of domestic business. The findings made by ITU are presented in the Innovation Strategy of the Republic of Moldova for the period 2013-2020 "Innovations for competitiveness", approved by Government Decision no. 952 of November 27, 2013 [11].

To analyse IT knowledge and its application in entrepreneurial practice, Global Innovation Index (IGI), allowing international comparison of innovation results, as well as Innovation Union Scoreboard are applied [3].

According to the findings of the Innovation Strategy of the Republic of Moldova, "the positions of the Republic of Moldova are insignificant in terms of online presence". The number of higher-level generic web domains per 1000 people in the Republic of Moldova is only 2.0 units, compared to 2.9 units/1000 people in the CIS and 22.3/1000 people in Central and Eastern Europe. It speaks about a low presence of Moldovan companies and organizations on the Internet, which is an essential barrier to the promotion of national products (see Figure 4).

According to the same document, rapid expansion of ICT use is taking place in the Republic of Moldova. Increasing the level of digitization by 10 percentage points contributes to increasing the country's score in the Global Innovation Index by 6 percentage points. Between 2005 and 2012, the number of Internet users increased from 16.2 users per 100 inhabitants to 50.5 users. Sixty seven percent of companies submit electronic tax returns via Internet. Broadband Internet penetration reached 14% in 2012.

The use of IT and Internet is of crucial importance for the innovation process. First, they ensure cheap and efficient dissemination of information about existing innovations and allow

companies to copy, adapt and improve these innovations. Second, Internet has a huge impact on educating consumers, who become more informed, and even become creators of innovation.

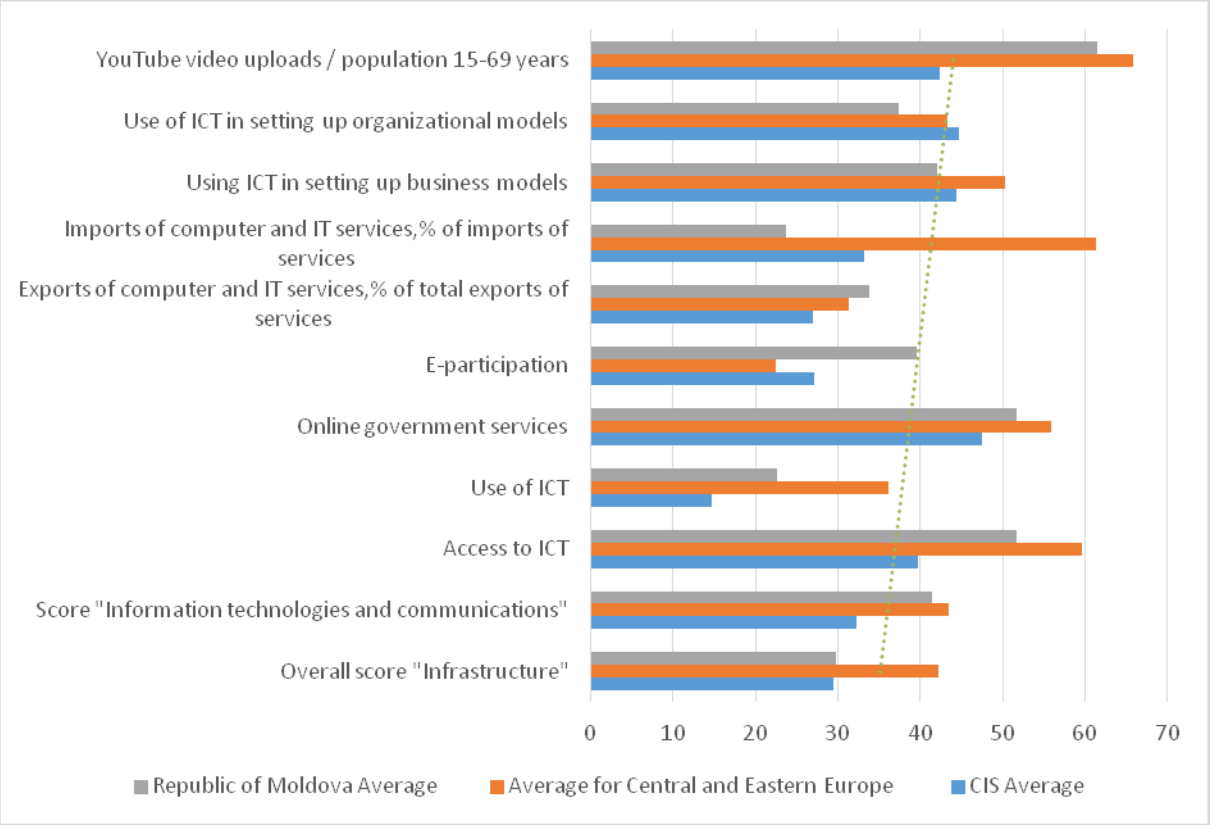

Figure 4. Comparative analysis of the Global Innovation Index components: Republic of Moldova, CIS, Central and Eastern Europe

Source: adopted from the data presented in the Innovation Strategy of the Republic of Moldova for the period 2013-2020 "Innovations for competitiveness", GD no. 952 of November 27, 2013, IGI 2012[1] [11].

Another document on computerization and digitization of our country was the National Strategy for building the information society – "Electronic Moldova", GD No. 255 of 09.03.2005. (Repealed in 2013). In 2005, the Government of the Republic of Moldova considered as priority directions of the Information Society Building Strategy increasing the competitiveness of companies and creating new jobs, using the opportunities offered by new information and communication technologies in the development of e-commerce, modernization of business, finance and human resources management, promotion of new products and services.

Instead of the repealed Strategy, the National Strategy for the Development of the Information Society "Digital Moldova 2020", GD no. 857 of 31.10.13 [12], presents, starting with 2013, the situation regarding the number of Internet users, the degree of households endowment with computers, broadband Internet access, mobile phone penetration, etc. Although our country is ranked 7th in the world in terms of Internet speed, and ICTs have reached the level

[1] Note: IGI 2012 scores are the result of normalizing some indicators on the scale from 0 to 100, higher values indicating better results or higher inputs.

of 10% of GDP - all these are characteristic elements of the third industrial revolution and not the Industrial Revolution 4.0., which requires the use of robots, artificial intelligence, cloud computing, blockchain in industrial production.

Analysis of the degree of use of robots in the industry of the Republic of Moldova shows a very low level. Robots require huge investments, as well as knowledge for their handling and maintenance, which the country is lacking. Even world's major industrial manufacturers, which have invaded the country's economy in recent years, such as automotive companies, manufacturers of wiring, car parts and accessories, use human labour that is currently cheaper than robotic. At the same time, automation of production processes will reduce the number of jobs and cause withdrawal of these companies from the country, which will happen very soon.

According to "Digital Moldova 2020" Strategy, building the country's future is inconceivable without a digital strategy that would create ICT-based information and communication opportunities. In addition, entrepreneurs and government institutions need to maximize the use of government data in favour of services for citizens.

The data of the National Bureau of Statistics say that the expenditures of legal entities for ICT were insignificant in 2018, being related to GDP.

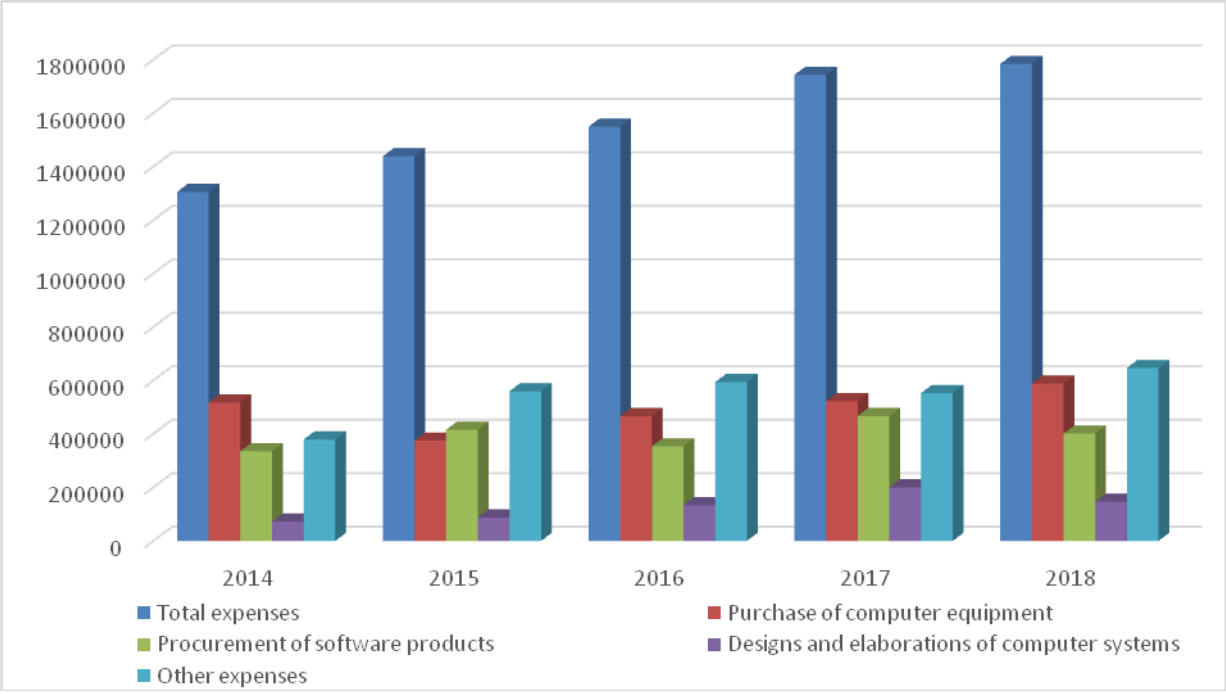

Figure 5. Expenses of legal entities on information technologies, by cost categories in 2014-2018, thousand lei

Source: developed by the authors based on NBS data http://www.statistica.md/category.php?l=ro&idc=139& [1]

The dynamics of these expenses is positive for the entire analysed period (from 1,305 thousand lei in 2014 to 1784 thousand lei in 2018) (see Figure 5). The largest share in total expenses belongs to expenses for the purchase of computer equipment (40% of total expenses in 2014 and 33% in 2018) and the smallest share was spent on the design and development of information systems (respectively 6% in 2014 and 8% in 2018).

By areas of economic activity, these expenditures are shown in Figure 6. The largest share of investments in ICT belongs to information and telecommunications activities (25% of total expenditures for information technologies in 2014 and 26% - in 2018) and to financial activities and insurance (16% of the total in 2014 and 23% - in 2018). The share of investments in ICT in the manufacturing industry reached 3.8% in 2014 and 6% in 2018 and in agriculture - 0.24% in 2014 and 0.27% in 2018.

According to statistical data, investments, costs and expenses for computerization of enterprises in 2018 amounted to a total of 1,549,706.6 thousand lei, which represents 1.14% of GDP (in current prices, 135,396,791 thousand lei).

The largest share of funds allocated for computerization in 2018 went to own funds in the amount of 77.8% of the total and allocations from grants and donations - 3.8%.

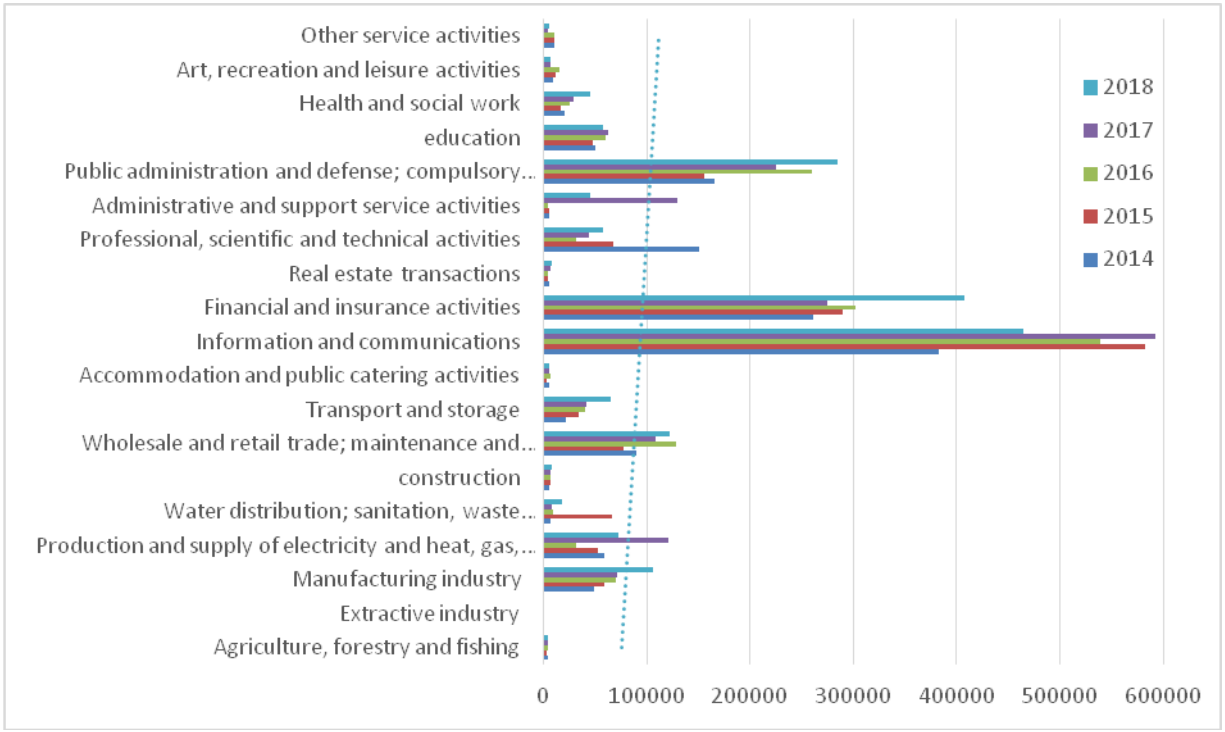

Figure 6. Expenditures of legal entities on information technologies by economic activities in 2014-2018, thousand lei

Source: National Bureau of Statistics, http://www.statistica.md/category.php?l=ro&idc=139& [1]

Investments in computerization, although growing year by year, are mainly costs and expenses for communication services and for purchase of computers, very few companies invest in digital technologies, software, automation and robotics of activities.

Unlike technologically advanced countries, in the Republic of Moldova there is no discussion about the Industrial Revolution 4.0. (there are only a few articles in the popular and press literature, as well as publications at specialized conferences). Industry 4.0 is very actively promoted by multinational companies located in Moldova (*Microsoft, FBS group, Endava, Star Lab*) and international audit companies (*PwC Moldova, KPMG, Baker Tilly Klitou and Partners*, etc.).

In Romania, Industry 4.0 is promoted by such companies as SIMENS, BOSH, FESTO, and Vodafone. However, neither in Moldova nor in Romania there is an interest from domestic companies for Industry 4.0.

Several Romanian researchers have already been warned about the huge impact of Industry 4.0 on the competitiveness of producers and products in the European market and the need for Romania to participate actively in this qualitative leap of European industry.

The main expectations from the implementation of Industry 4.0 innovations are the optimization of production processes and resource consumption by connecting equipment to the network, using artificial intelligence in production systems at supply, production and sales levels, also the use of "app-store" and "cloud" applications as new concepts in management. All this will generate an increase in productivity, a reduction in the duration of the technological process, a reduction in waste, customer satisfaction, an increase in quality and a reduction in the cost of manufactured products.

Next, we aim to perform the SWOT analysis regarding the implementation of Industry 4.0 tools in domestic production systems.

SWOT analysis regarding the implementation of Industry 4.0 tools in the national economy

Strengths (S)	Weaknesses (W)
▪ existence of a skilled workforce in the IT field; ▪ existence of communication networks; ▪ high-performance internet infrastructure; ▪ implementation of institutional projects: biometric passport, e-Declarations system, digital map, "e-government", etc.; ▪ master's programs in robotics, TUM; ▪ presence of courses in robotics and IT clubs for young people; ▪ attractiveness of the economy for foreign investments; ▪ a supplier industry for the automotive industry (this sector being one of the most attractive for Industry 4.0); ▪ collaboration relations with the German industry, promoter of Industry 4.0.	▪ lack of an efficient IT sector, with competences in the essential fields for Industry 4.0; ▪ lack of a coherent government program in the field of Industry 4.0; ▪ lack of research (with some exceptions) in the field of Industry 4.0; ▪ lack of research in the field of processing technologies in the literature; ▪ lack of financial resources and investments in IT; ▪ lack of interest from the banking sector in financing the activities specific to Industry 4.0; ▪ lack of specialists in organizing the production; ▪ lack of workforce qualifications in interdisciplinary fields; ▪ lack of interdisciplinary specializations (computers-sensor-mechanical technologies-materials-production organization); ▪ poor quality of students in some areas essential for Industry 4.0: machine building, mechanics, materials science, production organization, etc.

Opportunities (O)	Threats (T)
▪ development of digital skills, retraining of the workforce; ▪ increasing productivity and competitiveness of national products; ▪ increasing investments in human capital development; ▪ increasing investments in Industry 4.0 technologies; ▪ adapting to global and European trends in the digitalization of manufacturing.	▪ security of personal data and information; ▪ increasing the risk of cyber-attacks; ▪ job cuts as a result of automation and robotization of production processes; ▪ lack of qualified staff for the IT field.

5. Conclusions

The economy of the Republic of Moldova is not ready to face the challenges of the fourth industrial revolution, which began almost 10 years ago. There are many organizational, conceptual, financial and operational problems that, in our view, need to be addressed in the near future, namely:

1. Defining an Agenda for Industry 4.0 in the Republic of Moldova.
2. Inclusion of Industry 4.0 in the National Development Strategy of the Republic of Moldova.
3. Introduction of Industry 4.0 in the National Program of Research, Development and Innovation.
4. Promotion of Industry 4.0 concept in the academic environment.
5. Introduction in the curricula of colleges and universities of interdisciplinary courses addressing Industry 4.0.
6. Promoting and financing of studies in specializations: Machine building technology, Machine tools and production systems, Industrial engineering, Mechatronics, Robotics, Instrumentation and data acquisition, Telecommunication networks and software, Computers, Information technology, etc.
7. Motivating the involvement of Moldovan companies in Industry 4.0 Agenda.
8. Involvement of banking institutions in financing the initiatives of enterprises involved in Industry 4.0 program.
9. Accession and active participation in European platforms and agencies whose field of interest is Industry 4.0.

Industry 4.0 provides tremendous opportunities for innovative manufacturers, system vendors and entire regions. However, as in previous developments, Industry 4.0 is also a serious threat to those in difficulty. With the change in business models, economic and qualification requirements, we could see major changes in leadership positions, both at the company level and at the regional and international levels.

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Rezumat

Industria 4.0 reprezintă o provocare politică, economică și socială pentru întreaga lume, al cărei obiectiv este de a absorbi inovațiile digitale în produse, procese și modele de afaceri. Multe țări dezvoltate din Europa, America și Asia au inclus conceptul Industry 4.0 în programele lor de dezvoltare strategică pentru următoarele decenii. Liderii în afaceri și producătorii mondiali acceptă provocările și oportunitățile digitale ca un salt conceptual al noilor realități generate de progresul tehnico-științific. În același timp, criteriile de evaluarea a performanței transformărilor în Industria 4.0 sunt încă puțin studiate, iar implementarea structurată și sistemică a acestor tehnologii în economiile naționale pentru multe țări nu este deplin definitivată. Astfel, în acest studiu, autorii examinează modul în care economiile europene au aderat Strategiei Industriei 4.0 și implementează în practică instrumentele ei, înregistrând performanțe în diverse domenii de activitate. A doua parte a cercetării analizează gradul de pregătire a Republicii Moldova pentru a accepta și aborda provocările epocii digitale în industrie și agricultură în contextul dezvoltării durabile. Drept bază de cercetare au servit rapoartele statistice și documentele de politici internaționale și naționale privind recunoașterea și acceptul noțiunilor de Industrie 4.0 și economie digitală pentru definirea unei trepte noi de dezvoltare a societății.

***Cuvinte-cheie**: Industrie 4.0, economie digitală, inteligența artificială, tehnologii informaționale și comunicaționale*

Аннотация

«Индустрия 4.0» - это политическая, экономическая и социальная проблема для всего мира, цель которой - освоить цифровые инновации в продуктах, процессах и бизнес-моделях. Многие развитые страны Европы, Америки и Азии включили концепцию «Индустрия 4.0» в свои программы стратегического развития на ближайшие десятилетия. Лидеры бизнеса и мировые производители принимают цифровые вызовы и возможности как концептуальный скачок новых реалий, порожденных техническим и научным прогрессом. В то же время критерии оценки эффективности преобразований в «Индустрии 4.0» все еще мало изучены, а структурированное и системное внедрение этих технологий в национальные экономики во многих странах еще не полностью завершено. Таким образом, в этом исследовании авторы изучают, как европейские экономики присоединились к Стратегии «Индустрия 4.0», и реализуют на практике ее инструменты, фиксируя результаты в различных сферах деятельности. Во второй части исследования анализируется степень готовности Республики Молдова принимать и решать проблемы цифрового века в промышленности и сельском хозяйстве в контексте устойчивого развития. Статистические отчеты и международные и национальные программные документы о признании и принятии понятий Индустрия 4.0 и цифровой экономики послужили основой для исследований по определению нового этапа развития общества.

***Ключевые слова**: Индустрия 4.0, информационные технологии, искусственный интеллект, цифровая экономика*

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