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Industry 4.0 – Advantages and Challenges in the Republic of Bulgaria

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Abstract **- A retrospective review of the innovation process with its advantages, as well as the challenges in the conditions of Industry 4.0 in the Republic of Bulgaria. The emphasis is on digitalization and the strategy for its implementa-tion, as part of the national strategy for increasing the competitiveness of production and the economy.**

Keywords - digitalization, Industry 4.0, strategy.

I. INTRODUCTION

Undoubtedly, industrial production is the backbone of the national economy. There is no other way, because every manufacturing enterprise, in addition to being a source of profit, is a generator of national gross product, and therefore of economic prosperity. Industrial enterprises are one of the largest employers and importers of taxes in the state budget [2].

However, when we talk about industry, we must not forget that its development depends directly on scientific and technological progress, and in particular on advances in automation, mechanization and robotics.

The innovation process in enterprises is continuous. Sometimes innovation brings with it revolutionary changes that are difficult for people to accept at first. Industrial production today makes the most of the scientific and technical achievements of the 80s and 90s of the twentieth century - Internet, mechanization, advanced production lines, computing power, maximum flexibility and integrity of production systems. It is the accelerated automation and robotics that make experts believe that we are on the threshold of a fourth industrial revolution, and according to some others it has already occurred.

What's new in Industry 4.0 and Smart Factories?

- Brand new methods of interaction between humans and machines;
- New methods for receiving, storing, processing and moving information;
- Decentralized solutions (maximum possible autonomy of cyber systems controlling production machines);
- New types of industrial intranet networks.
- Industry 4.0 is a collective term that includes advances in digital technology, artificial intelligence, robotics, the Internet of Things, 3D printing, and more.

The fourth industrial revolution has the potential to fundamentally change the structure of the economy as a whole. The production process will rely mainly on automation, with high-tech robotic machines playing a leading role. This means that the need for qualified staff to adjust and maintain them will increase. The interaction between the education system and business will have to be strengthened. Cooperation between individual research centers and universities on the one hand, and entrepreneurs on the other, will become an integral part of the staffing of enterprises. The main requirement for the staff in the company will be digital competencies.

Company management and business management models will have to be reformatted and adapted to new technological realities. If we assume that people will still be needed to run the company, then a completely new entrepreneurial culture must be nurtured, coordinated and understanding the needs of the factories of the future.

The interaction between the individual units in the industrial enterprise will undergo a radical change due to the decreasing role of man in favor of machines. This is

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done with the help of re-engineering in management and processes.

Bulgaria must have a competitive digital economy and a high standard of citizens based on knowledge and smart growth. To have a modern and secure digital infrastructure, a high level of education and training, favourable conditions for the development and implementation of innovations based on advanced digital technologies in the economic and social sectors and accelerated digital transformation of the economy to generate high and sustainable economic growth [15].

This is not science fiction. This is the vision set in the new draft strategy for digital transformation for the period 2020 - 2030. The document was prepared by the Ministry of Transport, Information Technology and Communications and published for discussion on the site for public consultations.

II. EXPOSITION

What are the main benefits of Industry 4.0?

Undoubtedly, this is a drastic increase in productivity, and hence the economic profitability of the enterprise. Experts predict that the machines will initially "take over" the work associated with monotonous and repetitive movements, so characteristic of the production line. This does not mean that the work done by man will necessarily be unnecessary. People are still better at creating unique and innovative products. Human spirit, ingenuity and entrepreneurship should also play a major role in the industries of the future such as optical and laser technologies [5, 6].

It should be noted that for people, the work of the assembly line is associated with extreme mental stress and physical fatigue. The more we automate and robotize, the more the productivity of the enterprise will increase.

Man by nature always resists the process of change. In the 19th century, during the industrial era in Britain, textile workers protested against the growing role of machines. The Luditi movement appears. Seeing the danger of losing their jobs, they crept into factories and broke sewing machines. But that did not stop the industrial revolution.

The initial effect was really bad for some of the low-skilled workers. This was especially true for manual workers. In retrospect, however, the industrial revolution has improved productivity and optimized resource use.

Where will the higher efficiency of operational management come from?

Industry 4.0 will make the most of software advances in resource planning. This means better programs, better predictive algorithms that will make better analyses. This will allow the production process to be even more optimized, cost-effective and easy to manage, control and maintain. Thus, losses in production such as technological defects, defects in processes, etc. will be minimized, this example is present in optimizing of induction heating depending of the electromagnetic field [8].

The enterprises of the future will increasingly focus on management while machines perform monotonous and repetitive production activities. As a result, it is very likely that management science will acquire new significance and even greater importance, because human capital will be directed in this direction.

What will be the challenges for the labor market?

The fourth industrial revolution brought with it many unknowns as far as jobs were concerned. Since it is based on automation and robotics, the most vulnerable groups will understandably be the low-skilled workers. According to some estimates from the beginning of 2016, 47% of current occupations in the United States occupied by people are at risk of disappearing as a direct result of labor automation. Another report from the World Economic Forum predicts the loss of 5 million jobs over the next five years. We should ask ourselves, "What will these people do?"

It is clear that a problem with future technological unemployment will arise. What can be done are retraining and training programs for workers who have just lost their traditional jobs so that they can continue working. If, for example, the miller has just lost his job in favor of a robot, then the person should be trained to maintain and adjust the machine. Or to manage it, taking advantage of its greater precision in making and shaping the details. This activity can be carried out both on site and remotely - even from home.

Unfortunately, retraining workers does not mean a complete solution to the problem, because many employees will still be out of work and will not be able to be hired back in the company. Forecasting the effects of Industry 4.0 is characterized by strong uncertainty. There is no way to predict with maximum accuracy what will happen in the next 10-15 years, especially when the human factor is involved, with all its complexity and dynamics [10].

But it is certain that the role of education, in-house training and national programs for retraining people with professions falling into the so-called. "Risk group" are extremely important.

This requires the efforts of both business and the state, which must increase their investment in science - scientific developments with practical application, strategies, industrial innovations, etc.[4]

As a result of robotics, there is an option to make adjustments in working hours and work shifts. However, shortening the man-hours spent in work does not mean legitimizing laziness, but redirecting human efforts to another field of corporate activity.

Industry 4.0 will bring with it the need for new skills and abilities. Change will not be easy, but if we look back,

we will see that there have always been professions that have disappeared, precisely because of technological advances. An example of such a missing profession is the profession of "telephone operator". The first telephone exchanges appeared in the early 20th century. The task of the telephone operators working in them (mostly women) was to manually connect the individual subscribers. This was done by manually plugging in telephone jacks into various jacks located on a large switchboard.

A key moment in modern industry will be cybersecurity and artificial intelligence management. What if the machines become too independent and start making independent decisions? All important questions that will be answered.

From the point of view of the present, we cannot predict with 100% accuracy how the problems caused by the fourth industrial revolution will be answered. And like any radical change, the industry of the future comes with its benefits and negatives. Man must adapt as much as possible and realize his place in the new world, which in any case must remain leading [9, 16].

It can be summarized that Industry 4.0 will be more technological, more optimized, more knowledge-intensive. As far as people are concerned, the emphasis is on education and the acquisition of the widest possible range of competencies.

The digitalization of Bulgaria is a priority in a new strategy

Bulgaria still does not take full advantage of new digital technologies and innovative business models. The state of digitalisation of industry varies across sectors, especially between high-tech and traditional sectors, and much of the workforce lacks basic digital skills [1, 7].

The strategy sets the implementation of six main goals:

- deployment of secure digital infrastructure;
- providing access to adequate technological knowledge and digital skills;
- unlocking the potential of data;
- digitization in favor of circular;
- low carbon economy;
- increasing the efficiency of public administration and the quality of public services.

The priorities are:

- digital infrastructure;
- cybersecurity;
- research and innovation;
- education and training;
- adaptation of the labor market - education, training and social protection;
- digital economy;
- Agriculture;
- transport;
- environment and climate;
- healthcare;
- finance;
- culture;
- misinformation and media literacy;
- territorial development;
- digital control;
- security and citizen participation in the democratic process.

High speed connectivity

Efforts should focus on building an efficient cloud infrastructure, data exchange tools, architectures and mechanisms for managing thriving data sharing ecosystems and artificial intelligence.

By 2030, the Republic of Bulgaria must ensure gigabit connectivity of all major socio-economic engines such as schools, transport centers and major public service providers, as well as digitally intensive enterprises. Support for high-speed connectivity must be accompanied by measures to increase citizens' digital skills and stimulate the demand for Internet-based services from the public and businesses [11].

5G networks and optical networks will be among the most important building blocks of the digital economy and society over the next decade. 5G technology is seen as a tool for industrial transformation through the deployment of new networks that will provide gigabit data rates with low latency and significantly improved performance and reliability. In addition, high-quality connectivity will be provided to consumers and businesses, which will also support the development of the Internet of Things.

Future 5G networks will also be able to serve artificial intelligence-based systems through real-time data analysis and management. The 5G infrastructure is expected to serve not only individual users, but also a wide range of professional applications, enabling innovative business models in multiple sectors. 5G technology will also support the development of the Industry 4.0 model.

Research as a factor in achieving economic growth

Research centers of excellence and centers of excellence with the potential to connect to European networks through the modernization of research infrastructure and equipment will be built, the strategy states, for example Technical Parks and Zones, Business Incubators and clusters in Bulgaria at the Base of Industrial Competitiveness [13].

Additional funding will have to be provided for specific market-oriented applied research in the field of digital technologies on a competitive basis. Efforts will be made to create conditions for attracting young scientists and internationally renowned highly qualified scientists and, accordingly, to provide support for the transfer of scientific results to industry and the public sector. Work will be done to strengthen cooperation between academic institutions, enterprises, especially those in the information and

communication technology sector for joint participation in research and innovation projects within the programs of the National Research Fund and the National Innovation Fund, as well as specialized EU programs. It will be necessary to facilitate access to innovation for small businesses, start-ups and public organizations [12].

Digitization of education

An adequate and modern management vision presupposes a massive use of all new trends for technological renewal of educational institutions, which is able to qualitatively change the process of educational development. One of this is example - Educations – development innovation of program „Nano-microsystems and electronics technique"[3]. Another example present in "Higher Education in the Republic of Bulgaria at the Crossroad – Problems and Measures to Prevent Them" [14].

The priority areas in the field of education and training should be related to the provision and maintenance of high-speed and secure basic communication connectivity, as a basis for offering educational services, digital management and network interaction between the participants in the educational and scientific process. It is also necessary to create and maintain a cloud-based learning environment for services, including software as a service (SaaS), infrastructure as a service (IaaS) and platform as a service (PaaS).

For modern quality education, modern flexible platforms for distance learning and knowledge control and content management must be implemented and developed [14]. Providing modern quality education inevitably requires the development, adaptation, implementation of digital educational content, as well as the identification and validation of valuable digital educational resources, providing opportunities for blended learning, distance learning (both synchronous and asynchronous), use of augmented and virtual reality, as well as artificial intelligence for training purposes. This was done very quickly in a crisis caused by COVID 19. In just two weeks, the training of pupils and students in an electronic environment began. At the moment, the process is reported as successful on both sides - trainees and trainers. Society is rapidly adopting and using new technologies and education is one of the first to take advantage of them.

Labor market

Most jobs already require basic digital skills. In the future, this trend will increase and it can be argued that all participants in the labor market will need these skills to work. At the same time, much of the workforce does not even have basic digital skills. It will also be important to provide reliable, up-to-date information on future trends in labor supply and demand. Follow-up should be training to acquire new or improve existing key competences and professional qualifica-tions and to acquire new skills for specific new jobs.

Investments in skills development and retraining in the field of digital skills acquisition and in the modernization of the education system will have to be encouraged.

Other sectors

Digitization is also planned to cover sectors such as agriculture, transport, environment, health, finance. Automated and connected mobility will play the biggest role in transport. The environment sector must rely on technologies that accelerate the balancing of the energy system through the faster deployment of renewable energy sources and smart grids to manage energy consumption and traffic management.

As for the health sector, it is working towards the National Health Information System.

III. CONCLUSION

In conclusion we can consider that:

- The innovation process in enterprises is considered, as well as its innovations related to Industry 4.0 and "smart factories";
- The interrelations between the separate units in the industrial enterprise are determined;
- The main advantages of Industry 4.0 have been identified;
- It is indicated where the higher efficiency of the operational management will come from?
- Are the challenges facing the labor market in the Republic of Bulgaria and in general identified?
- The role of education, in-house training and national programs for retraining people with professions falling into the so-called. "Risk group" are extremely important.
- The 6 main goals in digitalization are defined: deployment of secure digital infrastructure; providing access to adequate technological knowledge and digital skills; unlocking data potential; digitization in favor of a circular low-carbon economy; increasing the efficiency of public administration and the quality of public services
- The priorities for digitalization of the economy are formulated: digital infrastructu-re; cybersecurity; research and innovation; education and training; adaptation of the labor market - education, training and social pro-tection; digital economy; Agriculture; transport; environment and climate; healthcare; finance; culture; misinformation and media literacy; territorial development; digital control; security and citizen partici-pation in the democratic process.
- High-speed connectivity is needed, and that research is a factor in achieving economic growth and competitiveness of the economy;
- The need to digitize education, the labor market and other sectors of the economy.

The presented theses, facts and analyzes clearly outline the advantages and challenges facing us for a knowledge-based economy in the Republic of Bulgaria.

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