ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
ECONOMIC STUDIES

Volume 27 (1), 2018

Hristo Prodanov[1]

POLITICAL ECONOMY OF ROBOTIZATION

This article is about robotization and its consequences that are to become a precondition for serious social conflicts and contradictions. To prove this thesis, I first examine the process of robotization during past decades and especially during the past few years in order to illustrate the scale of the problem, which is on its earlier stage today, but is expected to change the economic and political reality of all societies in the years to come. After that, I examine two main views about the contradictions and conflicts that robotization brings. Firstly, attention is paid to the vision of techno-optimists, which corresponds mainly to the theories of neoliberalism and neoclassic. After that, the view of techno-pessimists is examined, related mainly to realistic and Marxist tradition in political economy. Several aspects of the contemporary discussion about the overcoming of the contradictions of robotization are addressed – mainly through reduced working hours, unconditional basic income and taxing robots instead of humans. The idea is that replacing people with robots will raise growing problems to all human societies, so steps must be taken to overcome the emerging contradictions. The important thing here is the need to address the education, innovativeness and the ability of the modern man for a fast reaction to the quickly changing economic and social environment. Everything now is about adjusting economies for the rising "Industry 4.0", which brings the question about the need of a new political economy to mitigate the contradictions of the transition from the Third to the Fourth industrial revolution.
JEL: H2; I3; O3; L5

The introduction of robots and the automation of production in the past few years is becoming today one of the central topics in the discussions about the perspectives of contemporary economics. In one degree or another, the robotization is seen as one of the biggest challenges the countries and their policies face today. As every fundamental technological change during the past industrial revolutions, this one demands today for new policies to make the necessary change, to acquire new competitive advantages, to compensate the problems and contradictions it brings. In this article I dare to analyze this change by examining the tendencies of robotization, the problems and discussions it brings, the politics of contemporary state to face the new challenges.

[1]*Hristo Prodanov, Ph.D., is Assistant in University of National and World Economy, Department "Political Economy", e-mail: h_prodan@abv.bg.*

1. Robotization – a main direction of the Fourth Industrial Revolution

The first robot was created in 1961 and used in a General Motors plant. This is how the beginning of the first generation of robots emerged. They were used mainly on the traditional conveyors where cars, washing machines and other material goods were created. For almost half a century, however, the robotization was not a technology able to bring a qualitative leap of production, although it was a national priority in some countries like Japan for example.

In 1987 the International Federation of Robotics was created to become a professional institution that could help and protect the robotization industry. It collects, summarizes and offers information about the development of that industry. Its members are the main manufacturers of robots, as well 12 national organizations of robotics in countries where the robotization is particularly successful. It coordinates and organizes international symposiums of robotization and annually publishes its findings in "World Robotics".

The robots can be humanoids, which means they are able to reproduce some version of the human body and there are quite advanced forms in this respect. But it is not always an imperative. In general, these are devices that can reproduce one or another set of activities related to each other with corresponding algorithms previously performed by humans. In this sense, they can be different versions of automated drones, self-managed cars or software that translates texts from one language into another or gives certain medical diagnoses, but in all cases related with a high degree of automation of certain human activities (Westlake, 2014, p. 6).

When defining the concept of the robot the International Federation of Robotics relies on the definition of the International Organization for Standardization according to which the robot is an automatically controlled, reprogrammable, multi-purpose machine that can be grounded on a fixed place or mobile. It can be reprogrammed and gain new functions without physical intervention. It has a multi-purpose character and can be connected with different applications, including new technical devices. We can change its control systems and its technological characteristics (IFR, 2017, p. 1).

The transition into a second generation of robots is turning possible thanks to the new digital technologies after the crisis of 2008. Since then the robotization has become a new research field of the ongoing Fourth industrial revolution. The wider use of robots is stimulated by the lack of skilled labour, the rising labour cost, the need for greater competitiveness and the decreasing cost of robotic systems. They are rapidly becoming a centre of public discussions, research and scholarship. During the past few years, the blow of the interest about robotization has been grounded on the fact that some of the biggest companies have demonstrated a growing interest about robots. The Thailand Company Foxconn, a manufacturer of Apple products, announced that it planned to deploy 1 million robots in factories in China. After that Amazon bought the Kiva Systems robot company with the idea of robots doing the work in its huge storehouses. On the other hand, Google became an owner of Boston Dynamics – a manufacturer of military robots and started working on the development of commercial versions of self-driving cars without drivers.

What differs the new generation of robots from its previous versions is that now they have access to all kind of information from everywhere, and thanks to cloud technologies they are able to connect with networks of other robots. By doing that they can share information and in some sense are able to learn from each other, without the need of reprogramming. (Schaffer, 2016).

Unlike the first one, the current generation of robots is expected to play a role in all existing industries of the economy and major spheres of society, to interact more directly and personally with people. An important role are taking the robots that can assist in different human activities and interact with each other by using different networks. Increasingly persistent then is the question about the rules they obey – not only technological, but ethical as well. In the context of the creation of self-driving cars without drivers, a discussion emerges about the ethics of this kind of vehicles and how to realize it with appropriate algorithms (Winfield, 2014, p. 38-39).

The new versions of robots are very adaptive to changes, and their structural and functional features are increasingly being constructed by reproducing complex biological structure. The use of new kind of sensors enables robots to understand and adapt more easily to the surrounding environment, to reproduce more and more functions previously done by humans. The development of a new discipline about artificial intelligence is very important for the improvement of robots. This discipline deals with the development of algorithms able to extract information from different kind of images, including three-dimensional ones. That is how the robot is able to acquire adequate information about the surrounding environment and to react when it changes.

The field of activities conducted by robots is expanding, as well as their ability of self-education and autonomy. They are becoming a factor that changes production, exchange, distribution and consumption. Traditionally robots have been used in automobile industry, but today there is a tendency of robotization in many other spheres – electronics, retail, healthcare, logistics, agriculture, services, education, and government. Robots are now actively introduced not only in production, but also in hotels and restaurants. They are increasingly used in large storehouses, replacing low skilled workers that used to work there. Models used for childcare and for old people are manufactured. During the presidency of Obama, the robots took a leading role in American warfare strategy, grounded on the use of drones to pursue terrorist in dozens of countries all over the world.

Surveys show that the investment in robots contributes to 10% GDP per capita growth in OECD countries between 1993 and 2016. This is why the sales of robots are increasing and in 2015 were sold 15% more robots than in 2014. In 2019, according to the International Federation of Robotics, there will be about 2,5 million industrial robots (IFR, 2017, p. 1).

According to the UN Human development report from 2015 around 200,000 new robots are brought into the world every year. Their main consumer is the automobile industry, which is the main export industry in many countries. Despite the financial crisis between 2009 and 2011 the sales of industrial robots jumped with 17%. Moreover, the sales of robots are growing because of the crisis and the need for stronger competitiveness. They were indispensable in activities that involve risks of accidents and harmful effects on workers. It turns out that robots able to carry out routine tasks are much cheaper for the companies than

the use of labour force. Calculations in Germany show that the expenses for robots performing routine tasks are around 5 euro per hour (including technological assistance and the expenses for electricity), while the cost per worker, including salary, medical and pension insurance, is around 40 euro per hour (Human Development Report, 2015, p. 79, 81). This is why for example "Domino" pizza chain in Netherlands and Germany is already using robots to deliver pizzas, drinks and deserts. Because of the growing amount of robot market the forecasts of analytical companies show that the world expenses for them can grow from 71 billion in 2015 to 135,4 billion in 2019 (Gaudin, 2016).

Robots are mainly used in production. In 2013 there were 1.3 million industrial robots, and by the end of 2017, they were expected to reach 2 million (Hagerty, 2015). Their introduction decreases with enormous speed the working places in production. A typical example is the Chinese company Changying Precision Technology, a manufacturer of mobile devices, which had 650 workers, but with the robotization now they are only 60. In the same time, the production volume increased with 250% and the share of defective goods decreased from 25% to 5%. The number of needed staff is expected to decrease to 20 and this is a tendency that will overturn the whole production sphere in the world during the next decade (Monetary Watch, 2017). Companies like Foxconn are also producing about 30,000 robots per year. Global e-shops like Amazon are replacing people with robots in their warehouses, where their goods are located and loaded for the users – until 2016 there were installed about 15,000 robots. It is expected that soon Amazon and Wal-Mart will be able to use drones to deliver goods for their customers.

The robots are also increasingly used in medicine – robots are now operating prostate, they are used in eye surgery and in hundreds of clinics all over the world the four-armed system "Da Vinci" is now used for surgical purposes. The beginning of this tendency was in the 1980s, and in 2015 there were already 3000 working devices. They are produced by the company Intuitive Surgical. One hand of the robot holds a camera that shows an image of the operated part of the body, the other two hands are reproducing the movements of the surgeon, and the fourth hand acts as an assistant of the surgeon. They are used mainly for gynaecological and urological procedures. The procedure itself is controlled by a surgeon who monitors the operated part of the body. In 2012 the "Da Vinci" robots made about 200 operations (The Economist, 2012).

Along with the industry, healthcare and services, an important direction of radical change can be found in domestic work. The number of robots used in households is expected to rise from 3.6 million in 2015 to 31 million in 2019. The trade of robots able to clean homes and swimming pools is expected to rise about 13 billions of dollars only in US. We are witnessing the same tendency in the entertainment industry. In 2015 the total number of toy-robots, remote controlled multimedia robots and robots for entertainment was 1.7 million. According to the predictions of the International Federation of Robotics, the market for such robots is about grow to 11 million by 2019. Among them, the robots that are used as toys for different hobbies are occupying 70% of the market. A great amount is expected with the robots that can be used for old and disadvantaged people. Japan is a leader in this kind of technologies, because there is a great demographic problem, bringing the need for robots. In 2015 there were 4,700 of those robots, but they are expected to grow to 37,500 by 2019 (IFR, 2016).

Robots appear also in some spheres that seem to be very far from technologies – like religion, for example. In 2017 in Wittenberg (Germany) – the city that became famous when Martin Luther gave birth to the Protestant Reformation 500 years ago, a priest robot appeared who was able to read the Bible and to give blessings to the believers. There is a touchscreen on the chests of the robot. When he welcomes the visitors of the church, he offers them to choose a voice and a type of blessing, and then he raises his hands to the sky and says "God bless and protect you". This attracted a great attention even from not religious people. The introduction of this robot was made with the idea of provoking a discussion about the relationship between priests and believers, and about the role of the church in everyday life (Balberov, 2017).

From 2017 on the main metro-station "Prospect for Peace" in Moscow during holidays and special occasions the robot Metrocha – with his blue shining eyes and a touchscreen on his chest – meets the passengers, communicates with them, remembers their names, recognizes them, makes jokes, answers questions, takes pictures and prints them. His artificial intelligence gives him the ability to orientate and to overcome obstacles. Similar phenomena already exist in other parts of the world where robots work on information desks or like museum guides.

The most rapid development of robots for military purposes is already in progress. They are able to autonomously select and attack their targets. The so-called "killer robots" are quickly becoming a reality and are gradually creating the preconditions of wars that are to come with the Fourth Industrial Revolution. These wars will be something quite different from the First and the Second World Wars that were conditioned by the technologies of the Second Industrial Revolution of the mass conscription armies. The technologies of the Third Industrial Revolution brought the replacement of the mass conscription armies with professional ones, and now their role is taken by the autonomous weapon systems. This raises some stressing concerns about the consequences of robotization in this area, because machines are able to make decisions about the life and death of many people. This can lead to very dangerous consequences, people may die and no one will be responsible for their deaths. The concerns are also growing because of the already existing US practice during the presidency of Obama to fight terrorist groups in dozens of countries in the world with robotic drones, leading to a large number of innocently killed civilians. That is why on a UN meeting in Geneva in April 2016 representatives of 94 countries recommended formal discussions to be launched about the "deadly autonomous weapon systems" to see if they should be limited by international treaties (Docherty, 2016).

Robots were used in police bombing operations, and in July 2016 for the first time in Dallas a robot was used to murder a suspected criminal. In the years to come, the tendency is for robots and drones to be used in police operations.

Robotic drones are already part of the armies and engage in military operations. In Russia, they control the condition of oil pipelines. At the same time their prices are falling rapidly and in the beginning of 2016 autonomous, GPS-controlled drones were sold for about 500 dollars on the mass market. Only 10 years earlier they were multimillion facilities, a part of the military complex, and now it is expected that their prices will fall to 50 dollars for much more sophisticated versions, giving permanent computer picture to one project or another, using radar sensors, stereo-picture, voice and conversation records. This is why it is

expected over the next decade a variety of permanent control and supervisory systems to grow sharply with the help of the drones, especially in large cities, in the protection of property and in all risks. They can monitor traffic, crime, borders, to help with disasters. They are expected to solve infrastructure problems, to reduce pollution and traffic, to look for climate change and ecology. For this will also contribute the rapid reduction of their size and the increase of their intelligence, which will decrease on the other side the energy they use and will make them increasingly difficult to detect from a distance. Through them, the entire air-space will be digitalized and they will assume many of the functions so far performed by satellites (Diamandis, 2016).

A leader in the development of robots is China, where there were 900,000 robots in 2016, expected to grow to 160 000 by 2019; followed by South Korea with 40 000 robots that are expected to grow to 46 000 in 2019; on the third place is North America, where US and Canada had 38 000 robots in 2016, and the expectations are that they will grow to 46 000 in 2019. They are followed by Japan and Germany. The largest share of industrial robot workers is in Asia, and this is one of the indicators for the changing balances of power in the world economy (Bryant, He, 2017).

2. The discussion about the contradictions of robotization and the necessary policies of the states

Robotization strategies amongst the companies are a part of the market competition and the need for profit. At the same time, in the long-turn state strategies, they are related with the idea of strengthening the competitive advantages of the states as well as solving demographic problems. Their realization in countries with a rapid ageing of the population, like Japan, for example, is a factor for overcoming the lack of labour force.

In China, the state supports the development of robotics as it is losing its current competitive advantage of low prize labour force, which ensured the huge leap of the country for decades. Today China is losing that competitive advantage, because of the rising incomes and of the straitening of domestic consumption, especially after 2008. To this are added the prognosis about the ageing of the population, because of the long-term one-child policy, and the robots are seen as a factor that will keep production costs low and will be a reaction to demographic problems. It is even suggested that the pension funds should be used for buying stakes in robotic companies and enterprises.

Much sharper anyway are some other problems that bring a global discussion with different suggestions. They are about the different prognosis of job losses, rising unemployment and inequalities, changes of value creation, distribution of public wealth. In many areas, jobs that provided employment to a large proportion of the population during the Second Industrial Revolution, are disappearing. This tendency was typical, for example, for those who were employed on the conveyer, and since the time of Henry Ford have been seen as an expression of employment in the era of Fordism. Their work today is automated in its vast part. Robots increase public wealth and are for public benefit as a whole, but very quickly and in a larger scale than other technologies they seem to divide society of winners

and losers from the change. Winners are those who introduce robots and make a profit from them, as in some degree the consumers, because robots suggest lesser prices of goods and services. But losers can be a large number of people whose jobs are lost and whose income is decreasing, because they are occupied by robots. The main contradiction here is that robots are making our lives easier and prices lower, but at the same time they bring job losses and growing inequalities as a result of the elimination of the human factor in production. According to a report from McKinsey management and consulting company half of the world jobs are now in a risky situation, because of the automation. On average, over 30% of the activities of 60% of all the professions today can be automated immediately with technologies that already exist, and with the strong technology development, this percentage will quickly grow (Chui, Manyika, Miremadi, 2016). This is the case with professions that require physical activity, such as the profession of millions of drivers, which in the next decade is expected to disappear with the rise of self-driving cars and drones. The introduction of robots leads to improvement of the quality of work because they take over dangerous, tedious and dirty jobs that are not possible or safe for humans to perform.

But the intellectual professions are also at risk. A translator profession won't be needed anymore, for example, with the rise of advanced versions of automated machines for translation, which means that large disciplines will disappear in foreign language schools.

So we can conclude that the introduction of robots is becoming a reason for job losses, unemployment, and insecurity, lack of means for existence, growing social inequality and crisis. It is well known that from the first stages of industrial development this has given birth to contradictions and conflicts – for example, the attempts to destroy machines. This was the case in 1769, at the very beginning of the First Industrial Revolution, when the English Parliament adopted a harsh law in which the willful destruction of machinery was made a felony punishable by death (Mokyr, 1990, p. 257).

As we see, robotization brings many concerns about the rising inequalities and the losses of jobs. This leads to the question about the economic mechanism that drives these changes.

The first one is about the creation of value added. It is well known that in the 19th century Karl Marx considered it as unpaid human labour seeing the ability of the workforce to create value beyond its own. This value is appropriated not by the worker, but by the capitalist. For Marx, this is an exploitation category connected with the rising of working hours and lower payment. The rise of robotization changes this, because the work is not implemented by humans, but by the robots. Robot adoption is reducing labour's share in value-added. This is one of the reasons why the labour's share of national income has in recent decade fallen in many nations. This means that after the permanent capital, which today includes robots, is paid all the profit goes in the hands of capitalists and this is one of the possible explanations of the growing inequalities. We can see this tendency in the Oxfam report, announced at the annual meeting of World Economic Forum in Davos held in January 2018. It says that in 2017 82% of the wealth went to the world richest 1%, 18% in the hands of the "better half" of humanity and the poorest half of humanity received nothing. This means that 82% from the profit goes in the hands of capitalists and only 18% is distributed for the labour, and particularly for the highly skilled labour (Oxfam Briefing Paper, 2018, p. 8). This report seems like an indicator of how the new value is distributed at

the macroeconomic level. But if we look at the process at the microeconomic level, we will probably see the same tendency with a great amount of value distributed for capitalists and almost nothing for the labour. The main losers are the low skilled workers that are being replaced by robots. This means that a new workforce must be created to meet the needs of "Industry 4.0" and that the educational systems must concentrate their forces into this area. Otherwise, the countries will meet the consequences the low skilled labour, lower competitiveness, great poverty and inequalities with all the contradictions and social conflicts they bring.

But there is an opposite tendency that might mitigate the contradictions this process brings. It is called "prosumarism". During the Third Industrial Revolution Alvin Toffler formulated the "prosumattor" and "prosumatric economy" where people produce what they use. The concept stresses that with the rise of new technologies man can become producer and consumer of his own goods. This is particularly typical for non-material goods that are created and used by everyone in virtual space. But with the development of 3D robotics like 3D printers, it is expected this concept to become applicable for material objects as well. This means that in the future every human being will be able to produce his own goods and is expected to bring the end of capitalism and a new post-capitalistic era, because there won't be any more capitalists and workers. They will be replaced by prosumers. That is one of the possible trends, developed by the famous scholar Paul Mason in his bestseller „Postcapitalism: a guide to our future". The idea is developed also by Jeremy Rifkin in his book "The zero marginal cost society". There are already millions of prosumers – consumers in the world who create what they consume – producing their own green energy at a zero marginal cost. According to some data, there are around 100,000 people in the world who produce their own goods by using 3D printers at almost zero marginal cost (Rifkin, 2014, p. 9).

At the same time, from the point of view of a Marxist political economy, only human labour can create value. There is both use value and exchange value in every commodity. Capital (the owners) does not create value itself, but it controls the means of production and will only put them into use in order to appropriate value created by human labour. So in a hypothetical all-encompassing robot/AI world, productivity (of use values) would tend to infinity while profitability (surplus value to capital value) would tend to zero. This would be no longer capitalism (Roberts, 2018).

A second mechanism that drives people jobless with the introduction of robots is about the "value chains" – the set of activities that a firm operating in a specific industry performs in order to deliver a valuable product or service for the market. On the one side, there is a process of automation of the management of supply chains. Through robotization one can connect and automate sales, forecasting, replenishment, supply, planning, procurement, manufacturing and distribution activities. This is the way to improve your supply chains by: decreasing long-term costs; providing labour and utilization stability; increasing worker productivity; reducing error rate; reducing frequency of inventory checks; optimizing picking, sorting, and storing times; increasing access to the difficult or dangerous location. Process robotics automates the supply chain from end to end enabling in-tandem management of all different sections (Quasney, Fitzgerald, 2017).

At the same time for different products are possible radical changes in the value chains. During the Third Industrial Revolution, the main characteristic of the value chains was the de-localization – the process of spatial displacement of different elements of production chains in many countries to gain competitive advantage. This was one of the main catalysts for the economic growth in some developing countries, particularly in South-Eastern Asia. In the entrance in the Fourth Industrial Revolution, the tendency is for the competitive advantage to come not from the displacement of different elements of production in different countries, but with the introduction of robots, with automation and digitalization of the working process. In this way, the competitive advantage of the geographical factor is rapidly replaced by the technological advances of robotization. It is expected that in the future the value chains will be created only on a few production sights, mainly domestic and not worldwide. This means that companies would be able to create new value chains and to go back home without losing profit and many of them are doing so. The unfold of such a tendency is expected to limit the processes of globalization, and to replace them with de-globalization, "etatization", protectionism and self-closing, because it would be cheaper for the global corporations to turn their production back home – a tendency that is strengthening in the last few years as a result not only from robotization, but also from many other factors like the crisis, emigration, terrorism, the growing fear and uncertainty. The unfold of such a tendency means that a new political economy would be needed to justify a new relation between market and state in a situation when the regulative opportunities of the state are expected to grow. This also means that with the introduction of robots, the countries that have so far benefited from the low labour cost might lose this competitive advantage, and this is not an accident that countries like China, Japan or South Korea are accelerating the introduction of robots in production to benefit new competitive advantages in the new digital economy.

The more pressing question that stands today is what we should do now. In this aspect, there are opposing prognosis and analysis that give opposing solutions.

The first prognosis it that of techno-optimists. According to them, there may be a temporary employment reduction in some areas, but as in the past technologies are taking away some, but at the same time they are creating other jobs. Examples are given with previous technological revolution when the introduction of new technologies saved human labour and even increased the need of labour force. In 1950, for example, only 25% of married woman worked outside home and others were involved with work at home. In 2000 this percentage raised to 60%, and the assessment is that the half of the rise was because of labour-saving effects from different household appliances. Freed from the need to devote so much attention to domestic work millions of married women go to the labour market and begin to work outside the family, where the need of working force is growing, no matter new machines are constantly introduced (Avent, 2014, p. 16).

Similar forecasts are made for the future. A typical example is the joint research of IDC (International Data Corporation) – an international corporation of research and consultation in the fields of information technologies, telecommunications, consumer technology markets, market intelligence – and Salesforce.com, dealing with systems of client management and the perspectives about introducing artificial intelligence over the coming years. According to this research, conducted amongst managers from leading economies

like US, Germany, Britain, Japan, Canada and Australia, these technologies will create directly over 823,000 and indirectly over 2 million jobs. They will also rise the revenues of business with 1.1 trillion dollars between 2017 and 2021. The forecast is 2018 to become a breakthrough in this respect (Gantz, Murray, Schubmeh,Vesset, Wardley, 2017).

According to the International Federation of Robotics: "The future will be robots and humans working together. Robots substitute labour activities, but do not replace jobs. Less than 10% of jobs are fully automatable. Increasingly, robots are used to complement and augment labour activities; the net impact on jobs and the quality of work is positive. Automation provides the opportunity for humans to focus on higher-skilled, higher-quality and higher-paid tasks… Governments and companies must focus on providing the right skills to current and future workers to ensure a continuation of the positive impact of robots on employment, job quality and wages." (IFR, 2017, p. 2). Automation doesn't take jobs, although some professions may disappear and others to change their character thanks to the robots. That is why it is argued, for example, that the countries with the largest number of robots per employed population, like Germany and South Korea, have some of the lowest levels of unemployment.

According to John Tamny from "Forbes" magazine, "robots will be the biggest job creator in history". He is turning back to history and points out that every technological change has led to the destruction of jobs, but at the same time have created a growing number of new activities and professions. Robots will contribute to the biggest leap in this respect, because people will no longer engage in labour activity to survive, as it was in earlier history. Those activities will be for the robots. This will create a precondition for a growing number of innovations that will create new needs and new activities to satisfy them. Precisely because robots are creating a tendency for such a mass destruction of jobs and create more and more goods, new activities will become possible, that do not exist today. A growing number of entrepreneurs in innovative industries will be the founders of those activities and prospects. Robots will bring a growing profit that will be invested exactly in ideas that invent future with new services, new things, new strategies, new ideas and activities. Labour is not something static and unchangeable, the progress is about replacing old with new forms of labour, and the society creates new activities that haven't existed before. This characterizes all stages of human progress and the acceleration of progress has always been also an acceleration of the creation of new activities, respectively professions and jobs (Tamny, 2015).

This is the most optimistic forecast that expects market solutions to the job problems. From this point of view the main problem isn't about the lack of jobs, but about the rapid change of demand and supply of jobs, and about the measures state and market must take to react more adequately in the redirection, further training and changes in education to overcome the disparity between supply and demand of labour force. Undoubtedly, with such a trend we can expect an increase in the number of jobs in so-called creative industries, understood in a wider sense of the world like art, production of knowledge, innovations. Even now we are witnessing a growing demand for highly skilled workers for the digital economy, and at the same time – lesser demand for workers with low or without any qualification.

The second prognosis is that of techno-pessimists. Their voice is harder in the public sphere and is related to the prospect of a sharp decrease of the need of labour, which

will bring rising unemployment, poverty and inequality. Most of the world researches are showing exactly that perspective and this raises voices that robots bring unemployment and inequality. According to some prognosis in the years to come, the robotization of economies in a global scale will lead to the release of about 100 million jobs (Bria, 2016).

The study of Oxford University "The future of employment", published in 2013, analyzes 702 different professions in US and finds that 47% of them will be computerized during the next 20 years. The first wave will be about the introduction of self-driving vehicles that do not need people, which will remove millions of jobs in transport and its logistics. This, in turn, is expected to have a very hard consequence for the payment of labour force of other jobs, because of the great number of people who will be looking for jobs. In this situation, the institutions of power will have to look for a solution to the problem about the large imbalances in profits and losses from the technological development (Frey, Osborne, 2013).

According to a research of the National Bureau of Economic Research, any additional robot in the American economy is cutting the employment of 5.6 workers. At the same time, it is recognized that the relation between automation and employment isn't always direct. One of the main directions of development is about the growing production of the so-called "collaborative robots" that are smaller and more adaptive, created to work along with people. According to some prospects, their number will increase 10 times between 2016 and 2020 (The Economist, 2013).

The past experience from periods of technological changes associated with the extinction of traditional jobs from the era of Luddites in the late 18th and the beginning of 19th century shows that this leads to more riots, strikes, protest movements, conflicts, crimes, a growing number of homeless people, stress, aggression, violence and fear. Under the conditions of the liberal democracy today we can see the first symptoms of this in the two most advanced countries that had a global hegemony in the last two centuries – Britain with its "Brexit", and the conflicts related to the election of Donald Trump in US. It can be expected that this is just the beginning. So there is the question what must be done?

The big problem is that different surveys, based on expert assessments and made by managers and specialists, show that there are very big variations in the forecasts of job losses as a result of automation. Nevertheless, the question about the reaction of different states stands as they must meet the challenges of robotization. The most common suggestions are about taxing robots, the introduction of the ideas of unconditional basic income and the reduction of working hours, as was the case with previous industrial revolutions.

The first suggestion is connected with the transition from taxing people to taxing robots. It was made by Bill Gates and challenged a big discussion. Right now, he says, the human worker does $50,000 worth of work in a factory, that income is taxed and you get income tax, social security tax, all those things. If a robot comes in to do the same thing, you'd think that we'd tax the robot at a similar level. Gates even suggests slowing of automation process so there will be enough time to react adequately to the emerging contradictions (Delaney, 2017). Nevertheless, the idea of Bill Gates meets strong opponents. They stress on the argument that in this way the interest will diminish and the policies of introducing robots will not happen, because the taxation will make this process more expensive and the

country that introduces robots – a losing one. On the one hand, under these conditions, the companies will export their production abroad where the taxation isn't that big and job losses will happen nevertheless. On the other hand, foreign companies in countries where that taxation do not exist will start offering the goods and services at a much lower price, which will lead to the bankrupt of domestic companies. Under those conditions, this will mean a new closure of national markets, because otherwise the taxation of robots will be senseless. In the same time, this idea has its ground and the owners of robotized and automated jobs will be interested with it, because the robots will produce a growing number of production, which will not have enough consumers if the number of unemployed and poor people rises.

The second suggestion is about the introducing of unconditional basic income for everyone to solve the problems with poverty and the lack of consumption. This idea gains popularity among different scholars and economists with different ideological and theoretical orientations, as it is increasingly perceived that social networks are not able to cope with the new challenges and changes of labour. This idea meats strong support from other prominent representatives of the digital economy like the inventor of Facebook Mark Zuckerberg or Ellen Musk, who is a head of digital giants like Tesla and SpaceX. According to Musk we won't have a choice. "I think it's going to be necessary. There will be fewer and fewer jobs that a robot cannot do better" (Galeon, 2017). However, the pressing problem about the rising of funds for this universal basic income stands and there are radically opposing views about that. Liberal and market-orientated authors believe that the universal basic income for every citizen, even for jobless ones, will be cheaper than the current social system that requires a huge state and municipal administration to function. For example, Charles Murrey thinks that a 10,000 dollars annual income for every American can successfully replace the current security system, social services programs, agriculture funds, health programs, social benefits. All this can further reduce the cost and the administration of the state, which may, however, retain its functions in financing education, transport infrastructure and judicial system, but being a much smaller state (Murrey, 2008). More socially orientated authors view the universal basic income as a tool for modernizing of social security network so it would be able to adapt to the changes associated with the growing temporary, precarious work. This will give the people the necessary flexibility to adapt to the rapid change of jobs and professions. In this case, the basic income shouldn't become a tool for the destruction of the contemporary social state. Those alternatives bring a strong dispute that revolves around two main problems. The first one is about the raising of funds for the universal basic income. And the second one is whether receiving money for doing nothing will not demotivate people to work, educate and develop, which will be harmful for the economy. Currently, the labour-related economic contradictions have not reached such a scale to push the introduction of universal basic income, but there are many expectations that this will happen very quickly with the given circumstances of unprecedented technological and economical changes.

We should have in mind, however, that its introduction is connected with very important consequences. The introduction of universal basic income in any country is expected to boost emigration attempts from the poorest countries, because people from these countries will try to take advantage of it, i.e. its introduction will mean a much more active border closure. These actions, in turn, will be boosted by the fact that putting higher taxes required

by the universal basic income, will require a much stronger control on the revenues of companies and a limitation on their abilities to escape into offshore zones. Companies that have so far looked for the competitive advantage of cheap labour in one region of the world or another, which push them to create global value chains, will no longer need it and may be willing to return home where they can find more consumers for their production. This is expected to be, however, one of the mightiest technological factors that can create preconditions for the de-globalization of contemporary economics.

The third suggestion stresses on the need for a sharp reduction of working hours, and here we are turning back to the Keynesian idea for 15-hour working week. The problem is that in the past few decades there has been unregulated growth of working hours in areas that are difficult to be automated and robotized, because they are related to heuristics and creativity. Therefore, in practice, the relevant social groups work harder, not lesser. Automation reflects firstly professions and activities that are associated with the traditional regulation of working hours, which means that working hours in those activities will diminish, but in high payed and innovative professions the tendency is expected to be the opposite. And this is not accidental, because those who are routinely employed are less motivated comparing to those who are engaged in creative activities and self-realization. This is why the creative workers are tended to work more than others, i.e. it can be suggested that in the degree that low-skilled and routine jobs are reduced, at the expense of high-skilled, creative, innovative and unconventional ones, the people would like to involve more in the second kind of labour. This is also due to the fact that in most cases the characteristics of this work do not require a presence in the office or another concrete place in the standard working hours from 9 to 17, or within strictly defined age limit, 65 years for example, because work can be realized from home and in any time thanks to the social networks. For those workers not the fixed, but the flexible working hours become a leading standard as they can assess for themselves how much and when to be engaged. Age and physical abilities will not matter anymore at the expense of high-qualification, creativity and the ability to create something new and different. One can be physically very healthy, but if he lacks a qualification, digital skills and heuristics, he won't have any perspectives. The robotization will increase the role, place and importance of the human. Stephen Hawking, for example, is a man paralyzed in his home and in his wheelchair, but with the help of the new technologies he can make things that are impossible for millions of others. The distinction between work and leisure will become more blurred for more people, not only for painters, musicians, righters, scholars or professors, as it have been so far for the so-called free professions.

3. State strategies for the development of robotics

The emergence of robots, broadly understood as automated systems where different forms of artificial intelligence are integrated, changes the development strategies and aims of countries, the notion of progress. During the First Industrial Revolution, the symbol of entering the modern world was the railway. In one of his famous stories, for example, the Bulgarian writer Ivan Vazov tells a story of an old man who is blind, but nevertheless, he is

happy to “see” the first railway of the new liberated from Ottoman rule Bulgarian country. After that the symbol of the Second Industrial Revolution became electricity. And another Bulgarian writer Elin Pelin wrote in 1945 his famous story „The old water-mill”, where the new and bright future is seen with the electricity that "shines down the field in all villages and cities". It is well known that Lenin has seen electricity as a technological ground of his understanding of communist society. After that, during the 1980s, the symbol of the future became the computer. Today, AI and robots are playing a main role in the strategies of the future.

In the years to come, it is expected the collaboration between robots and humans to become a daily reality, so many countries are readjusting their economies and educational systems to answer the needs of “Industry 4.0” with a clear understanding that their economic power and future are strongly dependent on it. This raises a growing debate about the role of the state in the process, about the consequences for employment and productivity, economic policies that must be conducted by the states in the development of those technologies, and for the reactions that must be made to the contradictions, problems, conflicts they create. Countries tend to aim in their development strategies to go further in the deployment of robots. From a long time, this is a leading priority in Japanese industrial strategy, where robotization has reached a high degree in the automobile industry that gives it a strong competitive advantage. Because of the rapidly growing old population and the slow productivity growth, the Japanese government is aiming to rise twenty times the robots in use in the non-productive sphere and three times in the productive one by 2020 (IFR, 2017, p.5).

During the last few years, the development of robotics has been at the heart of the state strategies in China, South Korea and a number of other countries. China became in 2013 the main market for trade of robots and is expected to become the main manufacturer and consumer of robots. This is an economic necessity, because of the tendency of shortage labour force and the rapidly rising wages. Because of the size of its economy China is already the biggest market for industrial robots in the world, but in 2015 it had 36 robots per 10 000 workers in productive sphere and was still ranked 28th among the automated countries in the world. China is aiming to enter the top ten of automated countries with the mass introduction of robots in its economy, with the idea to introduce 150 robots per 10 000 workers by 2020. For this purpose the annual production of industrial robots there must grow to 100 000, which will be almost twice than in 2015 (Sheahan, 2016). This means that the Chinese companies will have to introduce around 650 new industrial robots between 2016 and 2020, which is 2.5 times more than in the whole world in 2015 (IFR, 2016).

For the implementation of this strategy, the crucial role is played not only by the state, but also by companies that are facing the conditions of the rapidly rising labour cost in China. On March 16, 2016 the Chinese government adopted the next five-year plan for the development of Chinese economy, providing millions for technology improvement, including robots. The creation of many innovative centres in the country is planned for their development. This will reduce the decreasing profit as a result of the growing wages in the country, and will make its products more competitive to the companies in US and EU. For example, the middle wage in Shanghai has grown more than twice for seven years. This is

why company like Cambridge Industries Group, facing the growing competition from the more automated Germany, Japan and US, is aiming to replace two-thirds of its 3 000 workers with robots, and is creating the so-called "dark factory" for this purpose. Given that in 2016 employment in Chinese industrial sector reaches around 100 million of people (compared to 12 million in US) and this sector has given 36% from Chinese GDP. This means that we are facing a great changes and challenges not only there, but also in the whole world economy (Knight, 2016).

Generally, the main problem about the robotization and the decline of employment is that all social systems created in 20th century, especially during the Second Industrial Revolution, are based on the questions how much, how, and what the cost of human labour is. On those questions is based the taxation for social purposes. This is the case, for example, with healthcare. Hundreds of millions of people receive health insurance thanks to their employment, but the loss of their jobs means they will not have the possibility to pay those bills. The question stands in this situation about the politics that must preserve healthcare for people, no matter the employment.

Big changes must be made in education policies as well. The current data in all areas and countries in the world show that the lower education of one person makes it harder for him to find a job and this means that the level of employment is strongly connected with the level of education. People without education or with low education are doomed, compared to those with high education, especially those who are capable to learn fast, who are innovative and capable to orientate versus new spheres. Changes in favour of jobs that require manual and intellectual work are extremely fast, dooming millions of people to a lack of life perspectives. A study of these changes in US between 2001 and 2014 shows that for that time the relative share of jobs requiring non-routine physical labour is up to 32%, and to those requiring non-routine cognitive work – up to 24%. In the same time the jobs requiring non-routine physical labour are 10% down, and those with routine cognitive labour – 8% down (Lieber, Puente, 2016, p. 6).

This means that the education should become a main priority for the states – more important than ever before. The problem is that the educational systems, as they emerge and develop from the modernization to nowadays, bring characteristics that were important on the different stages of human progress, but with the progress and after time they have lost their previous importance. Even today we can see some features from the early stage of this process in school years and vacations, which correspond with the traditional agricultural economy where the kids were working in the field during the summer. There are some characteristics from the era of mass education of the Second Industrial Revolution. It brings characteristics from periods when important was the great division of labour, in correspondence to that – the division of many educational disciplines – and not the convergence, which is the main feature of contemporary technologies. It was focused on the learning of a certain amount of knowledge, but today the main role is on the ability to process the information, to think innovatively and creatively, which suggests some changes in the foundations of education. The technical revolutions so far have made the period of education a basic feature of childhood, adolescence, and youth. After this period "man enters into life" and requires the status of an adult. Now, this is ending in a world where labour is becoming more insecure and no one can expect to find a job after school and to

hold this job until retirement, as it was for the generation after World War Two. The vast majority of people will have to change their jobs and careers many times, which means that they will have to acquire knowledge and skills again and again. Teaching and learning will not be any more a part of human life, they will always be his companion, and there will be perspectives only for those who consider this. Perspectives will be for those countries who can organize their educational systems according to the needs of the changing era.

More than ever the question stands about continuous learning that might give an opportunity for a fast redirection to a new sphere of employment in the conditions of the ongoing disappearance of jobs and professions. Chances to survive and to be robotized have only those jobs, existing today or in the future, which need creativity and emotional intelligence. This means that these characteristics must become central for the educational systems, in parallel with the digital literacy, needed for handling new technologies. To a very high degree today the education must correspond to the realities of the Fourth Industrial Revolution and to include the characteristics of digital societies and economies. This is how the deployment of unseen unemployment must be overcome, as well as the accelerated tendency of divergence between labour demand and supply.

We should also have in mind that in previous history labour was a sphere that gave a basic meaning to human life and there stands the question about preserving those meanings, aims, feelings of self-realization with a particular labour. We shouldn't underestimate the meaning of labour for human dignity. We are talking once more about gaining experience from the times of the growing unemployment from the 1930s when practices were introduced for the state to create employment programs towards some public goods of value for everyone. This can be particularly valid for the transition period when a large number of jobs disappear and when the time is needed to create new spheres of employment.

The robotization will have different consequences for the countries according to their economic development. The less technologically developed a country is, the more bets are on the cheap labour force, and the more disastrous and leading to severe contradictions and conflicts will be the consequences of this process. An important economical consequence from the introduction of robots is the reduction of the need of cheap labour, which creates a tendency where many industries are returning their production home where it is cheaper, unlike during the Third Industrial Revolution when it was cheaper to export those industries in countries with cheap labour. Therefore robotization is expected to have very disastrous consequences for countries, relying on a large amount of cheap labour. This is one of the preconditions for a new distinction between developed and developing countries, which raises new contradictions, especially about migrant waves. They may create a new geopolitical situation of a strong closure of states, tendencies of de-globalization, especially about non-qualified and workforce. If we look at the past, at the different cycles of capitalism, we will see that there were cycles of internationalization (globalization), universalization, free trade and decline of the role of the state, followed by crisis, growing inequalities and contradictions, introduction of new technologies and cycles of self-closure, "etatization", protectionism and increased role of the state brought alive to regulate the emerging contradictions. It seems that with the entrance in the Fourth Industrial Revolution we are at the beginning of a new stage of self-closure. We can see its manifestation all

around us – the Brexit, the election of Trump, the referendum in Catalonia, the rise of nationalistic powers, the building of fences between countries and regions seem to be a part of the same tendency. So the political economy of the Fourth Industrial Revolution is expected to be grounded on those tendencies that give more power to the state over the market. It is not a coincidence in this respect that scholars today are turning back for solutions in Keynesian or Marxist political economy, seeing a tendency very close to its nature to the one a century ago when free trade and internationalization of British global hegemony were replaced by self-closure, protectionism, and multipolar world with struggling for global hegemony new powers, but also with a strong state able to regulate the contradictions. Of course, it will not be the Keynesian or Marxist political economy, because of the different scale and character of the change, but this is a tendency that seems clearer in every passing day.

We can conclude that in the next decade the perspective is to an exponential jump in technologies and the economical tendencies they bring, which makes the politico-economic analysis of what we are witnessing today more and more necessary. Undoubtedly, we will have faster than ever before increase of public wealth, the emergence of new goods and services because of robotization, but meanwhile we will have an increase of all kinds of internal and external contradictions that will require a much stronger state intervention in robotization strategies to solve social problems and contradictions between demand and supply of jobs.

References

Avent, R. (2014). The revolution will be uncomfortable. – In: Westlake, S. (Ed.) Our work here is done: Visions of a robot economy, Nesta.

Balberov, K. (2017). Robot-svyashtennik poyavilsya v Vitenberge, Ruskaya Germania, viewed 09 June 2017, <http://www.rg-rb.de/index.php?option=com_rg&task=item&id=20782&Itemid=13>.

bloomberg.com/gadfly/articles/2017-01-09/the-robot-threat-donald-trump-isn-t-talking-about>.

Bria, F. (2016). The robot economy may already have arrived, In: open Democracy. Viewed 16 June 2017, <https://opendemocracy.net/can-europe-make-it/francesca-bria/robot-economy-full-automation-work-future>.

Bryant, C., He, E. (2017). The Robot Rampage. Viewed 16 June 2017, <https://www.

Chui, M., Manyika, J., Miremadi, M. (2016). Where machines could replace humans – and where they can't (yet). – McKinsey Quarterly, July.

Delaney, K. J. (2017). The robot that takes your job should pay taxes, says Bill Gates. – Qartz Media, viewed 15 June 2017, <https://qz.com/911968/bill-gates-the-robot-that-takes-your-job-should-pay-taxes/>.

Diamandis, P. (2016). Eight 21st Century Emerging Technologies: Part 4. Viewed 16 June 2016, http://www.21stcentech.com/21st-century-emerging-technologies-part-4/.

Docherty, B. (2016). Losing Control: The Dangers of Killer Robots, The Conversation. Viewed 16 June 2016, <https://theconversation.com/losing-control-the-dangers-of-killer-robots-58262>.

Frey, C. B., Osborne, M. A. (2013). The Future of Employment: How Susceptible are Jobs to Computerization. Oxford: Oxford Martin School.

Galeon, D. (2017). Elon Musk: Automation Will Force Governments to Introduce Universal Basic Income. Viewed 14 February 2017, <https://futurism.com/elon-musk-automation-will-force-governments-to-introduce-universal-basic-income/>.

Gantz, J. F., Murray, G., Schubmeh, D., Vesset, D., Wardley, M. (2017). A Trillion-Dollar Boost: The Economic Impact of AI on Customer Relationship Management. IDC. Viewed 10 June 2017<https://www.salesforce.com/content/dam/web/en_us/www/documents/white-papers/the-economic-impact-of-ai.pdf>.

Gaudin, Sh. (2016). Robotization market expected to reach $135 billion in 2019, IDC says. Viewed 25 February 2016, <http://www.cio.com/article/3038723/robotization/new-markets-push-strong-growth-in-robotization-industry.html?sc_cid=70160000000q6CfAAI>.

Hagerty, J. R. (2015). Meet the New Generation of Robots for Manufacturing. – The Wall Street Journal, June 2.

Human Development Report. (2015). Work for Human Development. New York: United Nations Development Programme.

IFR. (2016). 31 million robots in household worldwide by 2019. Viewed 01 February 2017, <https://ifr.org/ifr-press-releases/news/31-million-robots-helping-in-households-worldwide-by-2019>.

IFR. (2017). The Impact of Robots on Productivity, Employment and Jobs 2017. – A positioning paper by the International Federation of Robotization. Viewed 20 June 2017 <https://ifr.org/img/office/IFR_The_Impact_of_Robots_on_Employment.pdf>.

International Federation of Robotization. (2016). IFR Press Release World Robotization Report. Viewed 01 February 2017, <http://www.ifr.org/news/ifr-press-release/world-robotizationreport-2016-832/>.

Knight, W. (2016). China is Building a Robot Army of Model Workers. – MIT Technology Review, May/June.

Lieber, J., Puente, L. (2016). Beyond the Gig Economy: How New Technologies Are Reshaping the Future of Work. Thumbtack.

Mokyr, J. (1990). The lever of riches: Technological creativity and economic progress. Oxford University Press.

Monetary Watch. (2017). Chinese Factory Replaces 90% Of Human Workers With Robots, Sees 250% Production Increase. Viewed 30 January 2017, http://monetarywatch.com/2017/01/chinese-factory-replaces-90-human-workers-robots-sees-250-production-increase/.

Murray, Ch. (2008). Guaranteed Income as a Replacement for the Welfare State. Oxford: The Foundation for Law, Justice and Society.

Oxfam Briefing Paper. (2018). Reward Work, Not Wealth: To end the inequality crisis, we must build an economy for ordinary working people, not the rich and powerful. January 2018, Oxford: Oxfam GB.

Quasney, E., Fitzgerald, J. (2017). Using autonomous robots to drive supply chain innovation. Deloitte Development LLC.

Rifkin, J. (2014). The Zero Marginal Cost Society: The Internet of Things, the Collaborative Commons, and the Eclipse of Capitalism. N. Y.: Palgrave Macmillan.

Roberts, M. (2018). UNAM 3 – the robotic future. Viewed 9 March 2018 https://thenextrecession.wordpress.com/2018/03/09/unam-3-the-robotic-future/.

Schaffer, A. (2016). Robots That Teach Each Other. – 10 Breakthrough Technologies, MIT Technology Review.

Sheahan, M. (2016). China seeks top-10 automation ranking by 2020: robot industry group. Viewed 22 July 2016, http://www.reuters.com/article/us-china-robots-forecast-idUSKCN102104.

Tamny, J. (2015). Why Robots Will Be The Biggest Job Creators In World History. Forbes, March 1.

The Economist. (2012). Surgical Robots: The kindness of strangers. January 18, 2012.

The Economist. (2013). The growth of industrial robots 2013. March 27.

Westlake, S. (ed.). (2014). Our work here is done: Visions of a robot economy. Nesta.

Winfield, A. (2014). The next big thing (s) in robotization. – In: Westlake, S. (ed.). Our work here is done: Visions of a robot economy, Nesta.