

University of Economics, Prague

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TECHNOLOGICAL UNEMPLOYMENT AND  
AN ATTAINABLE WAY OUT

*Bachelor thesis*

Author: Adelina Pavlova

Thesis supervisor: Ing. Petr Špecián, Ph.D.

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I hereby declare on my honor that I wrote this bachelor's thesis independently, and I used no other sources and aids than those indicated.

Adelina Pavlova

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## **Abstract**

The purpose of the thesis is to analyze the available information on the technological unemployment issue. The hypothesis of the thesis is that displacement of workers because of technological development has reasonable chances to happen in the future. Technological unemployment is a hotly debated issue. Some part of economists argue that technological unemployment is a short-term problem; others see it as a risk for society. Thus, at this stage it is important to identify controversy in studies, analyze proposed policies and suggest the possible strategies. In order to gain the in depth knowledge required for the thesis a literature synthesis methodology was used. The concluding recommendations for researchers and policy makers include three important points to design an appropriate policy measure: number of population in a region, specialization of a region, previous placement of a worker. The effective solution is considered a mix of policies to target the problem from different perspectives.

### **Keywords:**

technology, technological unemployment, labor policy, workers

### **JEL classification:**

**J00, O33, O38**

## **Abstrakt**

Práce se zabývá analýzou problematiky technologické nezaměstnanosti. Základní hypotézou práce je, že technologický rozvoj patrně povede k trvalému nahrazení mnoha pracovníků stroji. Technologická nezaměstnanost je dnes vášnivě diskutovaným problémem. Část ekonomů zastává názor, že technologické nezaměstnanost je krátkodobým problémem; jiní ji vidí to jako dlouhodobé strukturální riziko pro společnost. Práce analyzuje problém technologické nezaměstnanosti a politiky, s pomocí kterých lze jeho dopady na společnost mírnit. Práce usiluje o syntézu stávající literatury, aby na jejím základě mohla být formulována konzistentní strategie možných opatření. Závěr práce tvoří doporučení pro další výzkum a tvůrce hospodářských politik. Základní dimenze, které je při tvorbě politik vzít v potaz, jsou tři: počet obyvatel v regionu, specializaci regionu a předchozí umístění pracovníka. Efektivní řešení by měla představovat kombinace politik adresující problém technologické nezaměstnanosti z různých perspektiv.

### **Klíčová slova:**

Technologie, technologická nezaměstnanost, politika zaměstnanosti, pracovníci

### **JEL Klasifikace:**

**J00, O33, O38**

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## INTRODUCTION

The unemployment issue is one of the global challenges of our time. At the same time, the fact that fast development of technology nowadays is observable. One of the types of unemployment, connected with innovations, is called technological unemployment and it seems to be of quite recent origin. Besides bringing about long-term economic growth, productivity and improved standards of living technological change is also known for destroying jobs in some industries, especially among the low skilled, while creating jobs, which are often in different industries and require different skills. (OECD Jobs Strategy, 1998) It is becoming increasingly difficult to ignore the fact that existence of technological unemployment has a new development of the previous disputes about the process of automatizing an industry negatively influencing labor market. The first noticed appearance was made in 19<sup>th</sup> century with the Industrial Revolution going on. A group named after Ned Ludd, who reportedly destroyed one of these advanced looms, the *Luddites*, was formed in Nottingham, England. It included skilled textile workers threatened by the newly introduced mechanical looms that could be operated by low-paid, unskilled workers. The Luddites rioted and destructed the machines. (Ford, 2009)

However, there are issues to discuss. Today the modernization is taking us a new machine age. Computers, new software acquire new functions and become more productive in some areas than a human brain. They allow us to go through previous restraints. The exact consequences of the transition remain unknown, but the fact that it will influence in some way the development is doubtless. (Brynjolfsson, McAfee, 2014)

The dissemination of a new technological pattern has implied a new emergence of the old debate about the possible employment consequences of innovation. On the one hand, despite some reduction in employment, the economic theory has pointed out the existence of economic benefits, which can outweigh for the due to technological progress (Keynes, 1930). On the other hand, there is evidence that relatively high levels of unemployment in Europe have been partially due to the structure of manufacturing industry, with sectors dominated by process type of innovation being more important. Process innovation means having strategy in aiming at price competitiveness on the international area without expanding industrial base to faster-growing product-orientated sectors (Antonucci, Pianta, 2002).

There are two opposite approaches to the labor market's issue of technological unemployment. One line of reasoning is based on argument that technological unemployment presents only a short-term problem. Their argument operates with Luddite Fallacy phenomenon. (Ford, 2009; Brynjolfsson, McAfee, 2014) This reasoning implies technological progress meaning machine automation will never lead to systemic unemployment.

The opposite side sees it as a risk for society. There is evidence obtained through quantitative research proves that faster technological change is likely to increase unemployment substantially (Feldmann, 2013). The advocates of view that technological progress causes major negative impact on labor market suggest possible solutions like Unconditional Basic Income and Negative Income Tax, which is statistically approved to be a sufficient tool. (Parijs, 1992; Cooper, 1983; Feldmann, 2013)

This paper will provide a synthesis of various respectable sources on the issue in a structured way to give the reader full insight of the problem, to clear the controversy and to provide base for future research. The main purpose of the thesis is to prove technological unemployment to be major unemployment issue in following years and suggest the most acceptable and efficient solutions given current framework.

Firstly, I will present existing approaches to the technological unemployment as an important issue. Then I will list and analyze popular solutions suggested by economists, intellectuals and social thinkers. Close attention will be drawn to the proposal concerning expanding social security. In the end, I will introduce requirements for solutions to be imposed and recommendation for how to approach the solutions. Not all solutions are applicable for a certain area, for certain economic system. It will include suggestion to create special expertise group in a region to directly deal with mass layoff, which will be the case in near future with this exponential growth of innovations.



## 1. BACKGROUND

Having job is the traditional and the most usual source of income. Mankiw (2006) notes that losing a job can be one of the most painful economic event in a life. Labor earning are crucial for maintaining standard of living. A job loss lowers living standard in the present, creates panic about the future, and reduces self-esteem.

Unemployment is a major economic issue, which influences almost all countries and their population either directly or indirectly. Raphael and Winter-Ebmer (2001) by analyzing the relationship between unemployment and crime in U.S., found that significantly positive effects of unemployment on property kind crime. Their estimation shows a strong connection between decline in the unemployment rate during 1990's and the decline in property crime rates. In addition, Nichols, Josh Mitchell, and Stephan Lindner (2013) recognize the job loss of a parent impedes children's educational progress and decreases their future earnings. These consequences are presumably because children whose parents suffer unemployment of a longer period and income losses can suffer decrease in their emotional well-being.

In most market economies not everyone will have jobs all of the time. It is crucial to understand unemployment and its causes in order to develop policies to help individuals who are going through the displacements. Unemployment rates fluctuation depend on the economic circumstances such as business cycle, overall economic situation.

Involuntary unemployment happens because of different reasons. Therefore, there are different types of unemployment. Mankiw (2006) describes three types of unemployment, which are different by time-dimension, degree of presence, the nature of causes:

- Cyclical unemployment refers to the year-to-year fluctuations around its natural rate, and it closely correlates with the short-term variations of economic activity.
- Frictional unemployment is the unemployment that results from the process of matching workers and workplaces. It generally explains relatively short streaks of unemployment.
- When the quantity of labor supplied exceeds the quantity demanded, structural unemployment comes into play. It represents longer periods of unemployment.

One part of structural unemployment is unemployment connected with the progress in technology. It defined by Keynes (1930) as technological unemployment. It appeared because the speed of finding new ways to economize the use of labor is higher than discovering new uses for labor. In other words, machines become sufficient alternate for a human in certain sectors of

economy. The examination of the sectors involved will be presented in the chapters Attitude and Possible. Solutions. In this sense, technological improvement opens a huge discussion between thinkers on how to manage this unemployment and what forecast is the most probable.

Economists, public intellectuals as well as ordinary people are divided on the issue of existence of this type of unemployment and on the solutions, they suggest. The following chapter will offer close observation to opposite opinions about technological unemployment existing today.

## 2. ATTITUDES

Every issue in economics or politics rarely has only one viewpoint. Technological unemployment is not an exception. While the probability of Luddites' anxiety about unemployment caused by technological improvements in production appeared again nowadays, the other view, which is more positive, represents technology as the main path for humans to enhance standards of living and become closer to the idealistic future. Economist John Maynard Keynes far back in 1930 in his work "Economic Possibilities for our Grandchildren" makes forecast that technological development would not only stop, but also proceed at a higher pace. At the same time, the economist recognizes that rapidity of these changes can lead to problems in countries, which are unprepared for technological improvement, meaning they mainly do not have up-to-date institutional base for dealing with new technologies. In this perspective, Keynes firstly uses the term Technological Unemployment, by which he means unemployment due to the discovery of channels for economizing the use of labor outrunning the speed at which new uses for labor can be found. Still Keynes sees this problem as a temporary phase.

Nonetheless, in contrast to the Keynes view, economic world was quite pessimistic in the first half of 20<sup>th</sup> century, primarily in 1920's and 1930's. Their perspective is understandable due to the post-war recession and signs of the Great Depression, which already started to be noticed, as noted by Rotwein (1945). It seemed to them that progress era of the 19<sup>th</sup> century is over.

Later on, as technology evolved, moods were also changing. In the book "Technology and Employment : Innovation and Growth in the U. S. Economy" (1987) by National Academic Press presents the message that in 1980s compared to 1950s and 1960s the U.S. economy experienced the higher level of international trade, the economy's availability to foreign firms appeared to be more rapid than in previous years. Combined with technological change influencing productivity growth this improved international relations environment is important for increasing incomes and securing jobs. Moreover, they claim change in technological standards is the key contribution to improvement of wages, and employment, and living standards as a whole, thus, it is not the cause of producing widespread unemployment. At the same time, authors do not see technology unconditionally leading to prosperity; they find it important to create efficient policies to help economy and society adjust to the changes less painfully. The same point can be seen in OECD Jobs Strategy report (1998), which mentions that besides bringing about long-term economic growth, productivity and improved standards of living technological change is also known for destroying jobs in some industries, especially among the low skilled, while creating jobs, which are often in different industries and require different skills. It is becoming increasingly difficult

to ignore the fact that technological unemployment has a new development of the previous disputes about the process of automation negatively influencing labor market.

According to Postel-Vinay (2002) there exist two main effects: capitalization effect and a creative destruction effect. The first one is explained as a case when a higher rate of growth implies a higher present value of jobs, which raises the job-finding rate of unemployed workers as a result of stimulated hiring activity. The second point is the opposite. It represents faster growth leading to an increase in long-run unemployment through a creative destruction effect. The intuition behind is that faster technological change is accompanied with faster destruction of skills, hence, more intense labor turnover and higher frictional unemployment. The actual problem arises about how to measure the effect. Postel-Vinay attempted to resolve this and created a model to capture the influence of the rate of technological change on the level of unemployment. The most important assumptions are that the cost of technological update is assumed large to make job destruction more profitable for the firms than implementing a new technology. Another one is that if already employed workers are not allowed to search for an alternative job. The conclusion Postel-Vinay gets is faster technological change also has a positive and important short run influence on the level of employment by causing a short-run drop job destruction. However, he admits that there is still not enough empirical support to do the short-run predictions of the model.

There is not such a separate term of technological unemployment rate on the databases. The reason could be, as already been mentioned, not enough research to capture this unemployment in exact numbers.

As reported in “Disruptive technologies: Advances that will transform life, business, and the global economy” (2013) by McKinsey Global Institute, nowadays, even though the presence of technology is becoming more remarkable, the ability to assess its impact adequately is still limited. Report suggests governments need better approaches to measure the full economic effect of technologies in order to evaluate their potential and to set an appropriate course.

Another report by Sengenberger (2011) shows the possible extensions to the measurement of labor market indicators. It can be reached by increased development and resort to statistics reflecting labor market dynamics, paying closer attention to the analysis of the size and nature of transitions in labor market status. He claims that the magnitude and variety of transitions has broadened, and the alterations to indicators and further researches should be carried out.

Despite not having explicit research on technological unemployment issue, attitudes differ across the society. There are two opposite approaches to the labor market's issue of technological unemployment: Luddite Fallacy and Technological Unemployment as a long-term problem.

## 2.1. TECHNOLOGICAL UNEMPLOYMENT AS A SHORT-TERM PROBLEM

Luddite Fallacy phenomenon, in other words Technological Unemployment recognized as a short-term problem, according to Brynjoflsson and MacAfee (2014), presents an approach that even if there are cases of workers losing jobs; technological progress brought about by capitalism creates better opportunities for workers. Consequently, unemployment has temporary nature and does not represent a serious obstacle to economy and society.

Early economists as already mentioned Keynes are included in this group of thinkers because of their confidence in technology, which will bring only positive long-term impact on employment. Their predictions are that the progress should make the working process safer, more comfortable and the people's living standards would have to be much higher in the following years. This optimism was due to some factors. The first, the technological improvement started to receive more attention. Secondly, technologies were not on that high level as it is today. In addition, their opinion can be seen as an implicit faith in future humankind to cope with the long-term consequences.

At this point, it is necessary to look at the capital - labor substitution concept, which is K. J. Arrow, H. B. Chenery, B. S. Minhas and R. M. Solow (1961) in their study on empirical observation that the value added per unit of labor used within a given industry varies across countries with the wage rate. While the data on the labor market is widely available with different indicators, data on capital inputs or rates of return are available for a small number of countries and industries. Substitution possibilities are an important determinant of the properties of dynamic labor-capital models and are of significance in the operation of the price mechanism in free-market economies.

García, Jaumandreu, Rodríguez (2005) show with their study on employment effects of innovation within the firm level that while displacing labor improvements create conditions on a firm level to recompense this displacement. Innovations in processes reduce marginal costs and this reduction continues with prices to expand demand, which influence employment. In addition, they claim positive potential net effects tend to persist in the long-run.

Another argument for technological unemployment not to be a serious issue can be Japan. Postel-Vinay claims that high capital intensity, large plants, and continuous processing characterize efficient sectors in Japan such as petroleum products, coal products, or nonferrous metals.

Ford (2009) acknowledges Luddite fallacy is generally accepted economic theory based on two fundamental assumptions about the relationship between workers and machines. First, machines are tools, which are used by, and increase the productivity of, workers. Secondly, the vast majority of workers in our population are capable of becoming machine operators meaning the average worker after proper training can add value to the tasks performed by machines.

Nowadays, there is an informal proof seen by an ordinary human that people are being replaced. For instance, the increasing presence of automatic systems as self-checkout in a store or automated gas stations is noticeable for an ordinary person.

If look at the issue from another angle, Bostrom and Yudkowsky (2014) draws our to attention to a different from technological unemployment issue. It is a possible existential risk when Artificial Intelligence machines are to be placed in a position of being stronger, more trusted, or smarter than humans, then the discipline of machine ethics must commit itself to seeking human-superior niceness instead of just human-equivalent. From this point of view, technological unemployment is important if thought only in margin. Technological unemployment crisis would simply be a short break on the way to a more dangerous crisis involving artificial general intelligence. The Machine Intelligence Research Institute supports this position. Sotala, Yampolskiy (2013) suggest to guaranteeing the safety of freely acting AIs with value learning. In their opinion, it would seem like the most reliable approach if it could be made to work, with human-like architecture a possible alternative which seems less reliable but possibly easier to build.

The Luddite Fallacy attitude is not considered as reflecting real situation. It does not take into consideration the future possible negative impact and does not suggest any definite policy framework. Rapid technological change is good in its nature. However, it require much policy flexibility and a good tools to protect workers against the costs of rapid change.

## 2.2 TECHNOLOGICAL UNEMPLOYMENT IS A PROBLEM THAT SHOULD BE RESOLVED

The second stream consists of economists who understands the positive side of technology, but also take into account the possible negative long-term consequences. The view is being advocates in this paper.<sup>1</sup>

Every economic transaction or issue involves agents. Main agents concerning the unemployment problem can be divided into four groups, which are government, or policy makers, employers, trade unions, and employees. Jackman and Roper (1987) define technological unemployment as a subgroup of structural unemployment, which represents the structural imbalance in whole labor market. Thus, displacement of workers does not only affect employees and their families, but as they are becoming less involved in economic activity, the whole economy is negatively influenced. The costs of unemployment to society are difficult to calculate, but it does not make it less important. Feldstein (1978) claims that the social cost of unemployment should be judged by considering the precise policy by which a worker would be reemployed. Different policies may have different opportunity costs for the unemployed workers. Feldstein identifies the importance of comparing the particular net social cost of unemployment, meaning the future benefit of returning the unemployed person to work with the cost of implementing the policy.

Technological improvement is a result of advances in sciences, which importance is out of a question. In already mentioned OECD report (1998), authors recognize the importance of the sufficient mechanism for translating technology into jobs meaning efficient system training and innovation and rigidities in product, labor and financial markets. They see the positive impact of technology on productivity only if the framework of applying is satisfactory.

There also the risk that technology will totally replace some labor-intensive industries. In 2011, European Commission published annual review “Employment and Social Developments in Europe”. It is focused on recent changes in Europe’s job structure and provides an updated analysis of EU labor market. Report shows that the massive job loss is primarily in manufacturing and construction. While some of the fall in secondary industries (manufacturing) employment is in high-technology sectors, most of the employment decline is in low-technology manufacturing such as food processing and textiles. In addition, report admits that the decrease in manufacturing

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<sup>1</sup> Nowadays exists the group of people opposing technologies who call themselves “Neo-Luddite” (Glendinning, 1990). In general, they do not support the rapid technological improvement and see technology as a biased political tool. This attitude will not be given close attention, as they are considered extreme.

is less likely to be cyclical, though the significant growth in high technology manufacturing in Germany is also very striking. According to the Office for National Statistics of United Kingdom, The tertiary sector usually combined with quaternary sector is considered the largest part of the UK economy, around 70 per cent of the workforce employed in these sectors. Examples of tertiary employment include different services such as health, transportation, education, entertainment, tourism, finance, sales or retail. The quaternary sector consists of industries providing information services as computing, ICT (information and communication technologies), consultancy (offering advice to businesses) and R&D (research, particularly in scientific fields). The secondary sector is on the second place. These usually labor-intensive industries are now becoming more capital demanding as mechanization processes go on, meaning that less people were required to work on the land and in industry, as machines could carry out most of the work that people previously did. The employment in manufacturing industries are mostly endangered by technological improvement.

Antoucci and Pianta in their study “Employment Effects of Product and Process Innovation in Europe” (2002) note that in Europe nowadays the presence of industries where product innovations are implemented is smaller which leads to slower demand growth and job losses. They suggest the most realistic expectation is a continuing declining of employment and industrial base in Europe, if the governments take no different policy measures.

Another argument for the issue of technological unemployment being a major problem is retrieved from Ford (2009). He claims the Luddite fallacy is represented mainly by a historical observation. The expectation is technological advance to give rise to entirely brand- new industries in the future. Nonetheless, the nowadays situation shows it would not be so obvious in the nearest future. These new scope of industries will tend to rely on information and average worker will be left fewer opportunities.

In the paper “The Future of Employment: How susceptible are jobs to computerization?”(2013) by Frey and Osborne with the help of novel methodology estimated the probability of computerization for 702 detailed occupations, using a Gaussian process classifier. Analyzing number of jobs at risk and the relationship between an occupation’s probability of computerization, wages and educational attainment result they have obtained is that 47 percent of total US employment is in the high-risk category, meaning that these occupations are potentially automatable probably in a decade or two. The reason is that the main job tasks of manufacturing occupations consist of well-defined repetitive procedures. Therefore, they can easily be codified in computer software and thus outperformed by computers. Frey and Osborne



acknowledge the extent of computerization will depend on several additional aspects. Suitable engineering solutions will help to overcome this problem. Labor saving inventions are possible in case the access to cheap labor is scarce or prices of capital are relatively high. Further, regulatory concerns and political activism may slow down the process of computerization. The right combination of workforce securing and technology enhancing policies will help to resolve possible problems.

Technological unemployment being temporary issue can be viewed from a prospective of Machine Intelligence Research Institute. Its researchers concern more about creating Artificial Intelligence. Sotala, Yampolskiy (2013) discuss the importance of guaranteeing the safety of intelligent AIs. MIRI researchers are concerned about artificial intelligence level of development; as the technology improves, more and more workplaces can be done significantly better than by human.

Still, the main challenge is policy framework. In already mentioned report, MGI researchers recognize impact of technologies on employment to be the biggest challenge for policy makers. They declare that innovation should lead to the creation of higher value-added jobs, and when productivity goes without that innovation, the results are unemployment and economic problems. The report suggest policy makers should consider models for more frequent experimentation in the development of specific technologies, while continuing to invest in basic research. At the same time, governments should also have the responsibility to assess all the possible risks ahead.

New technologies require new business models—new ways of combining labor and capital to turn a profit. In addition, good macroeconomic policy will create encouraging macroeconomic environment to cope in the new conditions.

Detailed inspection of solutions for this particular unemployment issue will be demonstrated in the following paragraphs.

### 3. POSSIBLE SOLUTIONS

Unemployment issue makes policymakers to seek for good measures to cope with this issue. The difference of technological unemployment that it leaves less space for policy makers to use accustomed tools as creating new jobs when addressing cyclical unemployment.

Taking into account the day-by-day progress in technological sector and that the key goal of improving the technology is to make the production more effective and less consuming, policymakers should already have an approximate plan for the future to make technology improvement more positively affect the society than negatively. Without any attempt to act in a current framework, the consequences may be drastic in the future.

Different solutions suggested by economists, social activists and intellectuals are to be divided into five main categories: Temporary risk, Artificial limitation, Demanding projects, Education, Social programs extension. Solutions presented in the work differ by time-dimension, powers involved and the application features. The aim here was to identify and analyze as many suggested solutions as possible. There is possible to see the effect of some of the measures in a shorter time, but others require more time and more research. However, all propositions deserve the attention and explanation.

#### 3.1. ARTIFICIAL LIMITATION

Folsom in his paper “Health, Society and Envy” (1958) mentions artificial scarcity measure with regard to process of making the society healthy. He claims that this type of scarcity is essentially means deemphasizing competition. The mechanism of creating scarcity artificially Folsom explains as holding goods off the market or failing to produce.

Bronfenbrenner (1962) explains the term economics of abundance as making a good scarce so the amount demanded as a free good exceeds the amount supplied as a free good. Free good is explained as a good without any price or any valuation

Applying this concept to technology at another angle has it sense and may be supported by economists, which see technology as a risk in a current framework. It can be explained as giving up or at slowing down certain technologies, if fast technological improvement is causing a social problem as massive unemployment. However, here the risk can arise. Cancellation can be brought to the extreme and lead to complete banning certain technologies. Nevertheless, there compromises exist. If government recognizes technology improving faster than it can cope with the side backs, it can apply in way that is more delicate such as encouraging businesses to hire

people instead of enhancing automation. At a first sight, this view is valid, because it takes into account a human place in the labor. However, it may soon be seen as a “Luddites” or “Neo-Luddite” view, which is not popular among modern economists and producers. Moreover, advances in technology means higher competition, which a benefit of market economy. A country, which would apply this method, is probably lose its place on the international area. Eventually, the development of any sector cannot be stopped without consequences. Desire to improve the conditions of life is in people’s nature.

### 3.2. DEMANDING PROJECTS

This category involves propositions, which require a considerable amount of investment, huge work with people mentality, which means indefinite time framework.

In 1995, Jacque Fresco in Florida, US, founded The Venus Project to prove the idea of a resource-based economy. The creators of this alternative economic system explain it as a system in which all goods and services are available without the use of money, barter, or any other form of debt. One of the main point is that society already have advanced enough technology to make available food, clothing and other needs and also supply itself with renewable resources. Consequently, when education and resources are available to all people without a price, there would be no limit to the human capability, and science with technology should help to accomplish.

This is a reorganization of society with clear socialist points. The advantage is the benefit of technology improvements that will help to solve some of the traditional problems of socialism like incentives of workers and inefficient distribution of resources.

This approach can be used individually in the households. However, it will need a huge work with changing way of thinking in order to change the lifestyle.

Obviously, these suggestions requires huge investments and structuration work which can take much more time than the founders propose.

### 3.3. EDUCATION

Way that is more fundamental and time-consuming is to invest in education, which has always been a traditional way to implement ideas and to prepare for the future. If people lose jobs because of machines then solution is to make people more educated and ready to cope with changing environment. The obvious step would be better education, supported by technological innovations such as online distribution, augmented reality, gamification, individualized learning

environments. However, there is another way is to use technological advances in medicine and enhance people capability with the help of drugs, brain stimulation or genetics science techniques. For now, this method is still being studied and we observe no mass application. Education is more straightforward considering current situation.

Schumacher in his book "Small is Beautiful" (1973) writes that society is entering the era called 'the Learning Society'. He says that science and technology must help to achieve not only productivity goal, but also people have to capture in mind the problem of equality among different parts of society. Nowadays when the technology is implemented into the everyday life of an ordinary person, it is important to prepare the future participants of the labor market to live and to work within these circumstances. This is the point when the STEM fields step in. STEM is an acronym for Science, Technology, Engineering and Math, as noted by Gonzalez and Kuenzi (2012). Mentioned disciplines are becoming wider required and necessary in current framework. This solution consists of the small changes in policy to boost education and encourage technological improvement simultaneously. Unfortunately, this process will take much time and investments to see the effect.

The idea of new stream in education. With the process of overall technological development, new ways of learning appear as online courses by huge variety of universities, TED conferences, different applications and games. Problems become complex from year to year, specializing on the teaching psychology in order to improve people's skills including motivation techniques, skills aimed at best usage of computer has its reasons. These times are the period of ending average science. Specialization is more important nowadays. However, bureaucratic regime and regulations still put sticks in the wheels and the science is not developing at a full speed. Nonetheless, reorganizing education in order to make it sufficient and technology-friendly has it obviously important point.

Another type of education solution, which is in lines with social security, is retraining such as work internships, online learning, and business incubators. Graetz and Doud (2013) suggest governments to qualify for job-creation grants and grants for training and retraining in areas with significant unemployment. In recent years business incubators were created in many countries; TechStars incubator has it branches in London, New York, Berlin. In Russia, there is a trend of creating universities aimed at IT field combined with incubators as The Innopolis project. The projects offer people become entrepreneurs, people learn quickly, react to changing conditions. These skills are the most important skills in the fast-developing future.

While machines are becoming more involved in production, McAfee and Brynjolfsson in their book “The Second Machine Age” (2014) claim that machines cannot completely overtake the human’s place on the labor market. They labeled the human’s advantage over computers as ideation meaning the process of creating and innovating. There are many forms existing where humans take the shine out of machines, for example, science, journalism, professional culinary, engineering. The authors suggest that many of these activities are supported and stimulated by computers, but none is inspired by them.

There are many areas where a person can have a fruitful competition with technology. If combined with the previous solution, the comparative advantage of a human capability in certain fields this view does not seem doubtful. Cowen (2013) admits there are opportunities for human to co-work with machines with benefits. Computers are mostly used to analyze and interpret the results, but humans are still the much better data-gatherers. Even systems with the latest updates need a human to control it and to maintain. Mentioned authors note the existence of areas where the computer does not any chance to over-perform humans, for example, consulting, law, and finance, as they require ability to improvise and sometimes to suggest unexpected effective decisions.

The combination of competition with the education transformation can help society and people suffered for digitalization to prepare themselves by acquiring new skills.

### 3.4. SOCIAL SAFETY PROGRAMS EXTENSION

These types of unemployment solutions are obvious. Since machines will replace many workers, they will not have an opportunity at least temporarily earn income. Providing them with guaranteed basic payment makes sense, as this money will be added to overall consumer spending. The idea of basic income has many supporters as M. Friedman, P. Parijs, and G. Standing. Sometimes the concept of guaranteed income or Unconditioned Basic Income is considered socialistic. However, the primary goal is to save market from destabilization.

Ford in his book The Lights in the Tunnel (2009) advocates the approach which, is similar to the Unconditioned Basic Income claiming that putting money in people’s hand will help the market economy continue. However, there is a difference. It within the incentive scheme that Ford suggests instead of unconditional payments. Saying in other words, this scheme is sort of the conditional cash transfers, which require special criteria and certain programs for people who want to get the payment.

Providing unemployed with basic income is not the only way to secure society. Other types of implementing social security nets includes stamps or vouchers that can be spent on certain purposes. In addition, government can directly supply with food, housing and other necessary goods. In this case, measures are needed only to support families without contributing to the market.

Unconditional Basic Income and Negative Income Tax are the measures mostly and hotly discussed among economist for a long time. The most obvious advantage of the UBI or NIT is that all social security programs as unemployment benefits, insurance can be used at once. The detailed examination of this solution will be offered in the following chapter.

Leontief sees two ways of how to deal with the enlarging use of innovations in the workplaces. The first one is to rise steadily the real wages to make workers voluntarily reduce their work hours. However, in current conditions, it would require substantial increase in labor's share of the national income that it would slow down the productivity growth. The second measure, which is more realistic one, is to practice income policies such as welfare payments, medical insurance and unemployment benefits. The mechanism of applying these tools, however, should be redesigned in order to equalize the well-being of full-time workers and involuntarily part-time workers, and at the same time, it should not interrupt the process of advancing technologies.

Some of solutions mentioned in this list are manageable and governments can already do research and then implement. Others are still seem unrealistic these times. They need more time to become effective and influence the labor market positively. Nonetheless, each analyzed policy approach may be applied as a part of system combined with other measure. Moreover, it would be more efficient and target the issue from different prospective.

#### 4. SOCIAL SAFETY PROGRAMS EXTENSION

Among all suggestions made in the previous chapter, the most straightforward solution is create, change or recombine the policy measure.

There are some reasons why Social Safety Programs are inspected in a way that is more detailed. One of the most important is that these measures can be applied straight away and their effects on the problem can be seen and analyzed in a shorter time than it takes to see the results of other implemented solutions such as changes in education. Another reason is that there are variety of researches made in previous years concerning the managing the social care system. The technological unemployment is sometimes difficult to detect, again the problem of disclosure and measurement arises. This question is in line for other researches. However, the idea here is that people become unemployed and government should take care of it.

In the report “Manufacturing Europe’s Future” (2013) by European think tank Bruegel authors declare accelerated improvement of information and communication technologies (ICT) resulted in marked reduction in the cost of complex activities between different firms. This report also claims high-tech is not naturally a tool against the loss of jobs because of the decline in the electronics-manufacturing sector in Europe. As the main drop in jobs rate is concentrated in the low-skill section, while remaining and new jobs being more skill intensive, even in the low-tech sectors of textiles and food.

To support potentially displaced workers social security nets can be performed in different forms such as, for instance, Unconditional Basic Income, Incentivized Income, or Vouchers. These types of unemployment solutions are obvious. Since machines will replace many workers, they will not have an opportunity at least temporarily earn income. All of them, starting with the most general measures, will be examined separately further in the text.

##### 4.1. UNCONDITIONAL BASIC INCOME

An Unconditional Basic Income (UBI) defined by Unconditional Basic Income Europe organization (UBIE) as an income unconditionally granted to all members of political community or on an individual basis, without criteria as test or work requirement. Unlike existing minimum income schemes in European countries, UBI is universal, individual, unconditional, and high enough to ensure an existence in dignity and participation in society. UBIE emphasizes that UBI should rather complete and transform it into an emancipatory welfare system, not used instead of the compensatory welfare state. UBI scheme is aimed at sustaining relatively equal conditions for living for all.

The idea of Basic Income goes back to the 16<sup>th</sup> century when Thomas Moore in his “Utopia” (1516) claims that it would be reasonable to provide everyone some means for life in order to decrease the criminal rate. The meaning of the term was being formulated during the following centuries. Many famous economists and politicians addresses this issue. An American physician Francis Townsend in his plan (1933) proposed a government to provide people over 60 years old with basic payment. After the devastating World War II the United Nations organization in the Universal Declaration of Human Rights (1948) proclaim that everyone should have basic needs satisfied such as food, housing, healthcare. It is obvious that the founders of the declaration had in mind the idea of unconditional guaranteed income.

Van Parijs (1992) claims the more desirable future is the Basic Income Capitalism. This term refers to a socioeconomic regime in which the majority of the means of production is privately owned and when each citizen receives substantial unconditional income aside from any income earned in the labor market. In Van Parijs words, a basic income is an income, which is not restricted to the work-prone and is made available ex ante. Basic income should be provided irrespectively of the household situation or the place of residence. In addition, Van Parijs does not connect the term Basic income with the some notion of "basic needs."

Sometimes the concept of guaranteed income or Unconditioned Basic Income is considered socialistic. However, the primary goal is to save market from destabilization. And Van Parijs makes a difference by saying that communistic (extreme socialistic) ideas did not truly lead the society to the stage of free society and the collapse of the communistic system has to prove it. The main goal of UBI according to Van Parjis is giving real freedom for all.

Standing (1997) supports the idea of universal guaranteed income. His arguments include transparency, which will arise, as there will be no work of selection for administrative offices and it will be easier for them to track all the payments. The other argument is that criteria based schemes leave place for political targeting, as politician want to have more votes, they will promote social programs which will not target all unemployed who need support. In addition, Standing predicts that with the ongoing development in economic, labor, regional sectors the labor market is going to be less secure. As the uncertainty arise, more and more people will not be able to imagine having control over their lives. One of the reasons of this uncertainty, Standing declares to be the selective, criteria based social policy. These measures rise the dependency and can be used by local, national or international politicians as a tool of pressure.



UBI issue is hotly discussed topic among economists and politicians. Along the supportive side of the measure, there is a critical group.

The main questions UBI concept is being addressed are if it is applicable in a current framework and where the financing come from. Some economists and social analysts are skeptical about this initiative.

White (1997), reviewing the Van Parijs's work "Real Freedom for All: What (if Anything) can justify Capitalism" (1995), analyses whether Van Parijs's arguments in favor of UBI are valid or not. One of White's main criticism of UBI idea is free-riding issue. He considers redistributing overall income it to be inappropriate and unfair for those who do contribute to earning the wealth. Robeyns (2001) mentions that a basic income might be a better social policy than a 'workfare' policy in the long run. However, in the short term, job creation by the government is more effective in reducing poverty and unemployment simultaneously. She also notes that it will be difficult to persuade governments to work on a long-term strategy of basic income due to the pressure of frequent elections.

Mitchell and Watts (2004) add some point against Van Parijs's advocacy of UBI. They mention that in for supports of universal income full employment is not existent by its nature any more, but it is a regular feature of the social landscape. Mitchell and Watts criticize UBI literature for giving little attention to the causes of income insecurity. At the same time macroeconomic analysis of UBI is limited in the main question: how the scheme would be financed. The advocates argue that the introduction of a BI is a means to reconcile the objectives of poverty relief and full employment. However, they do not present the exact mentioning of sources. The guess can be that UBI should be financed from taxpayers, which is counter- intuitive, as it will be more rational to free taxpayers above certain level of income from some part of tax. Here is the problem with constructing the scheme.

At this point worth mentioning Wispelaere and Stirton (2013), who challenge the administrative nature of the UBI. They put up questions such as how policy makers should design the mechanism of basic income, including financial part. Their conclusion is that this income is not straightforward in applying and managing. Their administrative analysis of UBI doubts on the likelihood that this political strategy would succeed. There are reasons for that. The first one is that such a strategy assumes shared agreement different political factions in a UBI coalition. If all agreed, the implementation stage begins when broad agreement must be translated into numerous operational details. At this point administrative challenges appear on the type of UBI,

the group of population targeted. Here is the high risk of administrative instability, which in turn produces political instability. This is the key administrative challenge that UBI advocates must overcome.

McAfee and Brynjolfsson (2014) implies his criticism of universal basic income by giving as an example Nixon's "Family Assistance Plan". US citizen did not the proposal, because the idea of tax they pay should go to people, who could work, but chose not to. The Family Assistance Plan was abandoned. Authors also note that federal elected officials and policymakers have not seriously discussed universal income guarantee programs since this case

Idea of UBI is still an ongoing discussion between economists and policy makers. It is obvious that this question need a proper investigation by econometrists on what is probable cost of applying, the effectiveness of it in a current framework.

#### 4.2. CONDITIONAL INCOME

Once discovered as an opportunity to cope with poverty or other social issue, the idea of Basic Income was spread out, and new forms of it appeared. Opponents of the Unconditional Basic Income usually advocate in favor of Basic Income based on criteria, in other words, Conditional Basic income.

White (1997) claims that unfairness of UBI can be avoided by introducing the conditional type of external wealth. In his opinion, the social payments should be based on reciprocity principle, which White explains as that, "Each person is entitled to a share of the economic benefits of social cooperation conferring equal opportunity in return for the performance of an equal handicap-weighted quantum of contributive activity". The term handicap-weighted means weighted by a degree of productive handicap, which is the limit of ability being engaged in production for individuals.

Ford (2009) advocates the approach similar to the Unconditioned Basic Income claiming that putting money in people's hand will help the market economy continue. However, there is a difference. It lies within the incentive scheme that Ford suggests instead of unconditional payments. Saying in other words, this scheme is sort of the conditional cash transfers, which requires special criteria and certain programs for people who want to get the payment. The incentives can look like working as volunteer, helping in environmental sector, and other creditable workplaces. According to Ford a program in which everyone is provided with a relatively equal unconditional income, provides no incentives for self-improvement, thus, no

hope for a better future. This is the problem with existing welfare programs. From a philosophical perspective, McAfee and Brynjolfsson claim that it is important for people to work not just because of earning income, but also because it is one of the principal ways they get many other important things such as, for example, self-worth, mental health, community, engagement, dignity.

Another form of -conditional income is widely used Cash transfer Programs. The schemes of Conditional Cash Transfers (CCT) are recognized to be effective measures at reducing poverty and income inequality primarily in many developing countries as noted by Loureiro (2012). Oportunidades in Mexico, Bolsa Familia in Brazil, Familias en Acción in Colombia, and Programme of Advancement through Health and Education (PATH) in Jamaica, is currently implemented also in Bangladesh, Chile, Honduras, Malawi, Nicaragua, Panama, Philippines, Turkey, and Zambia, as well as in other countries, listed by Angelucci (2011). Janvry and Sadoulet (2004) acknowledge these programs are recognized among the most significant innovations in promoting social development in recent years. In the study, they analyze the effectiveness Progresa Cash Transfer Program. This program was launched in Mexico in 1997 to offer cash transfers to poor mothers living in rural communities, conditional on their children using health facilities and school attending. The authors conclude government should not see CCT as handouts, but as contract between them and society to deliver some services. Moreover, Janvry and Sadoulet are concerned that CCT is more favorable than unconditional cash transfers, because of the price effecting mechanism, while aligning private and social behavior will be more expensive through income effects, which is basically UBI is done through.

If considering technologically unemployed people as a targeted group, CCT could be helpful for a temporary time. For instance, one of the criteria of eligibility could be that person attains some retraining program, and the sum that will be provided have to cover the period until finding new job, which is also can be defined by policy makers.

As in any social policy programs, there are obstacle to come through and Conditional Cash Transfer scheme is not the exception.

Rawlings and Rubio (2003) acknowledge that CCT scheme requires high administrative costs and its proposers mostly focus on short-term poverty reducing than long-term goals. Cameron and Shan (2013) concede despite wide using of CCT as a support measure for developing countries, there is rarely available he accurate and legally enforceable databases on tax and

welfare issues connected with cash transferring. As a result, targeting of such transfers in developing nations is very difficult.

Another problem, defined by L. De La O (2013), is that targeted programs as CCT programs increase the probability of pro-incumbent voting. L. De La O by analyzing experimental data on Progresa, Mexican CCT program, shows that increase in voter turnout in the 2000 presidential election was due to the CCT, not only success in persuasion.

Redistribution of wealth based on conditionality has a good point against the Unconditional Basic Income concept as it fights with free-riding and creates incentives. However, there are problems to discuss. While in case of UBI, the main question is economic effectiveness, the area administration creates a headache for policy makers on the inquiry on how to target or what groups of population should be targeted. Moreover, CCT programs are usually aimed at very poor population so may not be used towards the technologically unemployed. However, if in a following years society will encounter massive layoffs due to automation, CCT will have a reason to step into.

#### 4.3. NEGATIVE INCOME TAX

According to Cooper (1983), the concept of Negative Income Tax (N.I.T.) is simple. He explains its mechanism as the income tax paid by people whose earnings are above a tax threshold is regarded as positive Income tax and those, who are below the borderline receive payment from the state in a similar way. Cooper sees this policy measure to cope with unemployment to be straightforward and it does not have the major negative impacts on the macroeconomic conditions as indirect tools used to address different issues at the same time. Considering technological unemployment Cooper recognizes NIT to be a proper mechanism to prevent this type of unemployment by becoming a separate major issue.

Saez (2002) in his paper shows that the effectiveness of transfer programs such as the Earned Income Tax Credit (EITC) or the NIT depends on the labor supply response. The main of Saez's quantitative simulations is that the optimal program is sensitive to the size of the participation elasticity. Participation elasticity means in what degree people's participation as a labor force changes in response to change in policies. According to Saez, in case the participation elasticity is zero, the optimal program is a large Negative Income Program with a high guaranteed income. If the participation elasticity is large, the guaranteed income level should be lower. However, here \$5000-7000 should be excluded from taxation. The guaranteed income should be taxed at a high rate for a range from \$6000 to \$15,000. Thus, it is important differentiate participation and

intensive elasticity in empirical studies. Saez concludes that Negative Income Tax is the optimal program, when the behavioral response moves along the intensive margin, meaning intensity or hours of working. In this case, program should be accompanied by a large guaranteed income level, which is taxed at high rates. Nevertheless, if the behavioral response intensifies along the extensive, in other words, labor force participation margin, the optimal program would be an Earned Income Tax Credit with a smaller guaranteed income level and transfers that increase with earnings at low-income levels.

Pure Negative Income Tax, as explained by Moffitt (2003), is Friedman-style NIT. Milton Friedman suggested welfare programs should be redesigned with the negative income tax in mind. It means supporting those with low incomes would effectively work only at a low marginal rate. According to Hamilton (2010), this proposal has genuine concerns such as its questionable effects on labor supply and the possible gains from work requirements and welfare programs. Other trends exist nowadays that oppose Friedman's view, for instance, work requirements and the continuing proliferation of welfare programs. However, despite some disagreement, Hamilton claims that the idea of NIT has played its role to reestablish policymakers' understanding that incentives matter.

In comparison analysis of Earned Income Tax Credit (EITC), Negative Wage Tax (NWT) and Negative Income Tax (NIT), Allgood (2003) comes to conclusion that for responsive labor supply, the NIT brings about relatively higher net benefits for targeted group than EITC. In addition, if the EITC and the NIT are applied simultaneously and aimed at similar group, the NIT is more effective.

Despite having advantages, NIT deserves much attention among economists. While there are supporters, criticism has its place in the discussion.

Already mentioned Hamilton (2010) finds pure NIT is defenseless in case more recipients choose not to enter labor force. Due to weak screening ability, it is not possible to discover who could support themselves but choose not to work and rely only on transfers with this tax scheme. Hamilton is more in favor of EITC as it makes it possible to avoid the NIT problem of individuals who choose to earn nothing. Amine and Dos Santos (2013) are also concerned about the NIT advantages. In their article show that the increase in the tax credit makes the jobs offered less complex and firms less selective, therefore, the situation of low-skilled labor force would improve. However, while reducing the qualification inquiry leads to higher labor market participation, making unskilled workers better off, at the same time, the NIT has two main

negative effects. They are the decline of the matching quality, the decrease in workers' productivity and the increase of unemployment rate as the entry in the labor market becomes less attractive for firms, hence they create fewer jobs.

Obviously, it is difficult to choose one common policy suggestion addressing the problem of technological unemployment. Redistribution policy tool does not only target big issues helping unemployed but also creates certain displeasure among taxpayers, who are employed. All welfare programs cause some annoyance between different groups of population. Guaranteed payments are most likely to have more negative effect than positive, because if addressed and implemented poorly, these schemes would not serve the actual needs of people. The most favorable way is to place incentive in the guaranteed income scheme. Certain methodology should be design to ensure that person is eager to improve and not willing to free ride through taxpayers. For example, government can stimulate an unemployed to find a job by constraining the period when the social benefits are paid.

#### 4.4.RE-EDUCATION

Retraining as a policy measure is presented separately in the social security programs not in education for some reasons. Firstly, if changes in education are mainly considered ex-ante action in order to eliminate or lessen possible future crisis, retraining programs are used in order to deal with already existent problem, in other words ex-post. The need to develop new productive skills, to learn how to do something useful to society in this technological world is not being discussed. However, it requires society, including government and employers, to help quickly to retrain and provide capital, which is needed to work at the new location. An important factor in the accumulation of unemployment - is the guarantee of the state, reducing geographical and social mobility of the population. Thus, it may be useful to provide environment with better mobility when the question is to employ people. There are some evidence that requalification programs have confident impact in long term for unemployed.

In 1968 Ernst W. Stromsdorfer in his study "Determinants of Economic Success in Retraining the Unemployed: The West Virginia Experience" observed the economic costs and benefits of government retraining of the unemployed. His multivariate analysis has shown that the net effect of retraining on employment and before-tax income is positive and statistically significant. The result is that average financial benefits exceeded costs during the 18-month post-training period. However, here questions arise. Will all of those who are technologically unemployed be willing to participate? Certainly, not, considering different age, different policies. H. L. Allen, B.

McCormick and R. J. O'Brien (1991) confirm this concern by concluding that government should firstly recognize that those seeking retraining in order to design programs. They also see the connection based on observation of UK labor market between willingness to retrain and the economical situation. In typically discouraged areas, people would like to participate in these programs to a higher extent, even exceeding the number of provided places and their age is likely to be around 27. It is a well-known fact that elder people are less prepared for retraining. For them government should chose a different policy, such as, for instance, imposing compulsory retirement age. In some sectors, it will be higher, in other sectors, which are more demanding, shorter.

Benedict and Hart (1997) in their empirical study prove that the reemployment process is not difficult because of dislocation itself, but depends on different factors. One of the reasons is education levels that vary; high-educated people are more likely to find reemployment in growth sectors. Other important factors appear to be gender, belonging to a certain minority. However, they claim difference between dislocated are not dramatic if plant closing and job-termination take place. Benedict and Hart suggest for policymakers to target population more accurately, focusing job programs on unemployed workers in declining industries than focusing on all unemployed. Their results also advocate policies, which are aimed at increasing a worker's education to help in adapting to changes.

One of the widely required from employees skills nowadays is computer literacy. According to Freeman (2002), in the US, the growth of employment in the field of information technologies in the years 1989-2000 has averaged 2% a year. He also shows that while the unemployment rate for persons in this sector was 2% lower than the average unemployment rate in the country.

Based on this numbers, it is more clearly seen that re-education process should take place in higher degree. There is not only the so-called retraining programs. There exist some types. In the paper on effects from training programs Fitzenberger, Osikominu, Völter (2008) examined West Germany case. They compared the Provision of Specific Professional Skills and Techniques (SPST), a Practice Firm (PF), and Retraining (RT). SPST programs provide additional skills and specific professional knowledge in courses with a median duration. PF includes simulating real job environment and RT represents vocational training in a new profession. The three training programs differ by length and content. Their analysis's results are that despite having a negative lock-in effect right after the launching of programs, the overall mid-term and long-term effects positively influence on employment rates in a significant way.

The comparative analysis of different treatments showed that effects differentiate only by the length of that lock-in period depending on original program's duration.

Training and retraining, upgrading skills are one of the most promising technologies of social assistance for the unemployed. However, as was already noted, not a single measure can cope with such a big issue as unemployment. In the following passage, I present table of proposals with advantages and disadvantages. In chapter 5, I will offer my recommendations based on the analysis of studies.

#### 4.5.OVERVIEW

Table 5.1 Comparative summary

<b>Solution proposal</b>	<b>Advantages</b>	<b>Disadvantages</b>
Artificial Scarcity	Deemphasizing competition; Protecting labor force	Not supporting the useful technological development;
Demanding Projects	Socially desirable ideas;	Huge time and monetary investments;
Education	Fundamental; Long-term preventive nature;	Need for changing policy in Education sector. Huge time and monetary investments;
Unconditional Basic Income (UBI)	Easy targeting; Unconditional; Ex ante implementation; Equality aiming	Not defined sources of financing; Challenges for policy makers; Potential risk of free riding.
Conditional Basic Income	Incentives (eliminating free riding problem)	Challenges in defining criteria; Challenges in setting the level of transfers;
Negative Income Tax (NIT)	Well-defined mechanism; Absence of the major negative impacts on the macroeconomic;	Challenges in setting the level of payments; Decrease in workers' productivity; Weak screening ability
Re-education	Developing new productive skills; Long term positive impact;	Dependence of success on criteria such as demographical factors, sector of industry, macroeconomic situation of the region; Appropriate policy design needed.



## 5. RECOMMENDATIONS

The prediction of this thesis based on materials observed is that in decades with rapid technological improvement, industries will be modernized and as a result, there may be mass displacement of worker. I find it crucial to start refocusing existing policy measures to the issues connected with technological improvement more precisely.

I define two main obstacles for observing the technological unemployment in a full sense: statistics and the focus of policies. The problem in a current situation is the exact measurement of technologically unemployed people. Statistics lack this particular information. The reason is that the issue is recent. Thus it is crucial for governments to start investing in R&D sector to investigate the problem of this kind unemployment. Another important requirement is that governmental programs should be applied with local insight. A particular area determines which frames are needed programs to function sufficiently. I suggest three main points that should be considered when applying the policy tool:

- Number of population

It is clear that if the size of a city is up to one million, there are more opportunities to reemploy the people as moving them to agriculture or forest sector, whereas in larger cities it is more difficult as it limited with space

- Specialization of a region,

Specialization of region depends on geographical, climatic and resources availability conditions. Still the degree of employment dependence on the geographical location. However, taking into account the remoteness of some regions in a country from each other, the development of remote employment would be very important.

- Previous placement.

Benedict and Hart originally presented the idea of the third point. They suggest to focus on displaces workers from declining industries. This concept can be reformulated if applying for technological unemployment problem.

In order to deal with potential unemployment issue I suggest creating special office that will deal with unemployment connected to the automation. The main function of this commission is to forecast the possible mass work displacement and job termination in the region and to create

structured, coherent algorithm of actions to cope with issue. The algorithm should be based on the three points mentioned above designed and applicable for a certain region. The statistical and social researches made should not be based on a short-term policy measure. The more effective way to address technological unemployment issue is considered a mix of different strategies, which include long-term projects such as refocusing of education to prevent some part of negative consequences as well as short-term, for instance, retraining or guaranteed incomes, to cope with existing problems. In other words, preventive measures should be accompanied with already proved measures to address the matter from different angles.

## CONCLUSION

Changes usually step in bringing some degree of danger and some degree of success. Technological development brings many differences to life. It would be wrong to assess the impact of one-sided positive or negative informational technologies to the labor market. The modern economy poses a number of challenges for the economic theorists and practitioners. But the decision would have no problems of any discussed, the focus should remain a man, his place and role in society, impact possibilities of offered human society, the problems faced today people. One of the global challenges of the modern world - the state of the labor market: the employment rate and the unemployment rate, the structure of the labor market, trends of further development. The processes that are inherent in economy, and, of course, influenced by the changes associated with active information and communication technologies influence the labor market.

Despite diversification among attitudes towards the technological unemployment being a major issue, economist and other intellectuals offer possible solutions in advance. The growing number of technologies being able to replace human in the workplace may bring both risks and lucky chances. Thus, it worth to prepare for the worst. To make innovation cause more positive influence than negative laws, policy measures and suggestions must adapt quickly to changing environment. Proposals differ by time-dimension, investments involved and the volume of work needed. Short-term policies are needed to cope with already existent unemployment. Mainly they should be aimed at creating jobs to suspend the technological unemployment coming into big play. In addition, these measures should include redistribution and government programs to support individuals displaced because of technology for the period to make them able have means for life and the incentive to improve. The important point here is creating incentives to find work and not to cause the worry for taxpayers.

Refocusing education to the most modern fields such as STEM is an example of long-term policy. Education is a fundamental phase of creating future participants of labor market. Introducing more disciplines, which involve learning how to use technologies better, will help to eliminate a part of technologically unemployed in the future. The shorter version of this tool is re-education, which is ranked among social policies. It includes different types of training. Technology does not only eliminate jobs, but also creates new ones as intermediate workers, for instance, consulting, advertising, wholesale trade, insurance. They can help to improve he understanding how to work and live with innovations around.

The policy suggestion of this thesis is to form a special group to address particularly problem of unemployment, which will focus on special characteristics of a region to introduce efficient measures. The prediction is that in the future the society will experience mass layoff because of automation. In that case, a governmental structure should have already created certain methodology. There is no universal tool to solve any problem. The solution should be a mix of policies to target the problem from different prospective. The thesis provide the insight to the problem of technological unemployment and possible solutions. The more detailed measurement and research are needed to adequately assess the risk and take the preventive measures.

LIST OF TABLES

Table 5.1 Comparative summary

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