Industry 4.0 as the Culprit of Unemployment

DANIELA MAŤOVČÍKOVÁ
Vysoká škola manažmentu, Trenčín, Slovakia

Abstract: The exact definition of Industry 4.0 does not exist yet. Nevertheless, the meaning of number 4 is very well known. It represents the fourth stage of industrial revolution and is linked to spread of the Internet and digitalization. It is expected of the production to be fully controlled by robots in the near future and it is assumed that this fact shall lead to job losses. The article argues about threat of unemployment caused by the arrival of Industry 4.0.

Keywords: revolution; digitalization; unemployment; Industry 4.0.

JEL Classification: J6; E0.

1 Industrial revolutions

When are we going to buy a car that will fly? When will we enter a shop where just robots will serve us? Is this science fiction coming soon? The humankind is in front of the door leading into a different world. Our lives, working and personal, are going to change. We do not know how much; we are not able to say yet where all these changes will lead and what they will cause. Are we going to have better existence? Will our living standard rise? Or will our lives fall apart due to these major changes, and will the technological change push the human being into a deep abyss?

The expression "industrial revolution" can be used in connection with four major changes in production that have affected human beings. Up until now, all important innovations can be pinpointed to four periods starting at the end of the 18th century. The first industrial revolution introduced James Watt's steam machine that helped to mechanize production and affected mainly textile industry, metallurgy, transportation and engineering. The second industrial revolution brought in electrification that assisted in mass production and, apart from rapid railway development, affected iron, steel, paper and rubber production [1]. The third industrial revolution introduced computers and put emphasis on customization. It started around 1960 and was accompanied by demand for skilled workers and production being moved to low wage countries [2]. The fourth industrial revolution smoothly followed the third one and its base is in digitalization. It is expected that within a short time period machines will be able to communicate thanks to the Internet. This stage is marked with self-management, where people mainly cooperate with robots, where people communicate through mobile phones and access to information is unlimited. This stage will cause the birth of a smart factory. Will it replace the human work as well and cause massive unemployment? Four stages of industrial revolution, together with their features and consequences, are summarized in Table 1.

Tab. 1 *Stages of industrial revolution*

Stages of industrial revolution	Industry	Features	Consequences
First industrial revolution - England (1750-1850)	• Transportation Steam machine by James Watt (1765) • Metallurgy • Textile • Engineering	• Abolition of slavery • Moving people to towns • Specialization • New technologies • Capital accumulation	• Urbanization • Rise of population • Higher standard of living • Social revolution
Second industrial revolution – Britain, Germany, USA (1870 - 1914)	• Engineering • Telecommunication • Chemical industry • Maritime industry • Business management	• Cheap coal • Electrification • Mass production	• Railroads • Iron and steel production • Wide usage of machinery • Paper and rubber production • Fertilizers
Third industrial revolution (since around 1960)	• Transport • Computers • Metal machinery • Medicine • Genetic engineering	• Digital manufacturing • New processes • Clever software • Novel materials • Dexterous robots • Zero emission transport	• Mass customization • Production in low wage countries • Demand for skilled workers • Renewable energy

Fourth industrial revolution – Germany (since around 2011)	• All industries • All economies • All disciplines	• Digitalization • Internet • New technologies • Self-driving cars	• Digital enterprises • Artificial intelligence • Unemployment?

2 Industry 4.0

The whole European Union has always been striving for industrial production to increase and return to Europe. It has been a trend to move production into countries with low cost labour for a long time, yet higher productivity brought back into Europe could compete with cheaper labour force. It is important to alter the way we produce; it is necessary to bring in more value, to minimise the cost, to make more output with less input. Industry 4.0 could help us to reach this target.

The name "Industry 4.0" originates from the German phrase " Industrie 4.0", indicating where the concept of this expression started and came from. It all began in 2011, when the German government decided to analyse the consequences of new technologies on the national economy, and results were later presented at the trade fair in Hannover in 2013 [3].

The fourth industrial revolution – as Industry 4.0 is known for - is evolving at a very fast pace. It affects every industry in every country and changes it brings will modify production, management and governance as well. Impressive progress has been made in artificial intelligence, for example, from software used to discover new drugs to algorithms applied to predict our cultural interests. Digital fabrication technologies, meanwhile, are interacting with the biological world on a daily basis. Engineers, designers, and architects are combining computational design, additive manufacturing, materials engineering, and synthetic biology to pioneer a symbiosis between microorganisms, our bodies, the products we consume, and even the buildings we inhabit. Like the previous three revolutions, this one has the potential to raise the global income levels and improve the quality of life for populations around the world. Tasks we are used to, such as buying goods, making payment, booking holidays or playing a game, can be done from the most remote places. It is expected that the cost of transport and communication will drop, logistics will be more efficient and trading costs will fade away. At the same time, workers might be replaced by technologies and that shall disrupt the labor market [4].

Industry 4.0 is known for its data volume and possibilities to use it effectively. Companies nowadays can collect more information and use it in a more beneficial way. The question is which data are the most useful? Where does leakage of data cause problems? In order to solve incoming problems, manufacturing leaders can use a "digital compass" that consists of 8 basic value drivers and 26 practical Industry 4.0 levers (Fig. 1). This could help companies to find the levers that are best suited to solve their particular problems [5].

It is expected that Industry 4.0 will lead to establishment of a cyber – physical system, or an intelligent factory. The main features of an enterprise that is considered to be influenced by Industry 4.0 are:

- Interoperability — machines, devices, sensors and people that are connected and communicate with each another.
- Information transparency — the systems create a virtual copy of the physical world through sensor data in order to contextualize information.
- Technical assistance — both the ability of the systems to support humans in making decisions and solving problems and the ability to assist humans with tasks that are both difficult and dangerous for humans.
- Decentralized decision-making — the ability of cyber-physical systems to make simple decisions on their own and become as autonomous as possible [6].

The 'digital compass' helps companies find tools to match their needs.

[1]Maintenance, repair, and operations.

McKinsey&Company

Fig. 1 *Industry 4.0 levers*

The question is: would computer-controlled and fully automatic production or services lead to critical job losses in the future? It is expected indeed that by 2020, up to 5 million people will have lost their jobs [7]. How will it affect the rate of unemployment all over the world?

3 Unemployment

Existence of unemployment is an economic problem. On one hand, an unemployed part of the population does not contribute to gross domestic product creation, and on the other hand, it puts pressure on the state budget spending due to the payment of unemployment benefits. In case of this production factor not being used, the country cannot reach its potential output and the economy usually falls into recession. Unemployment is not only related to economically measurable losses but it also causes various social consequences in terms of the decline of the standard of living of the unemployed person and his/her family. Subsequently, stress and fear develop, and they might lead to alcoholism and increased crime rate. The impact of unemployment on the individual and society depends to a large extent on the length of duration of the unemployment. Negative long-term unemployment is mainly caused by low qualifications or lack of experience and causes the unemployed and their families to be excluded from social relationships, and they often live on the verge of poverty. Difficulties in finding a job have a negative effect on self-assessment of a person; his/her self-esteem is diminishing, which can then lead to the feeling of inferiority. Long-term unemployed people lose their acquired skills, which they do not use, and gradually lose their working habits, which deepens the situation of the unemployed.

Unemployment can be classified according to several criteria. If we consider the question of willingness, we distinguish:

1. Voluntary unemployment - which oscillates around the level of the natural rate of unemployment. The number of those who do not work is lower or equal to the number of vacancies. Even though there is a sufficient supply of jobs, it is not attractive for the unemployed.
2. Involuntary unemployment - which occurs when the number of unemployed is higher than the number of vacancies. Demand for work is higher than the supply, which is most often caused by the cyclical development of the economy.

In terms of causes, unemployment is broken down into:

1. Frictional unemployment - which arises as a result of asymmetric information. It contributes to an optimal allocation of labor because it assumes that the employee leaves the original job in order to find a more suitable job position in which he would be more satisfied. It usually takes a very short time - between one to three months. This is temporary unemployment caused by workers' fluctuation.
2. Structural unemployment - is caused by the fact that offer of a certain type of work is not available in the area. This unemployment affects, in particular, inappropriate

groups of workers who are not interested in retraining, if necessary. Although there is a job offer, there are no qualified unemployed people who could be employed in these places. This type of unemployment is very often caused by the labor force being replaced by machines.

3. Cyclical unemployment - which is typical for the period of economic stagnation and decline. It is a natural consequence of limited production due to a decrease in demand for goods and services. This is typical macroeconomic unemployment, which affects, to a certain extent, all sectors of the economy. It is related to not using existing capacities due to problematic sales [8].

4 Robots versus unemployment

It is obvious that in case of manual work being replaced by robots, machines and plants, we talk about structural and involuntarily unemployment. Indeed, it is expected that in the next five to ten years, all repetitive and monotonous jobs will be occupied by robots and many people will become jobless. In China, over 60,000 workers were rendered jobless in May 2016, when Foxconn decided to replace them with robots in order to lower the labor expenses and make the workplace more efficient [9]. If other companies followed the pattern, it could backfire. Unemployed people have no earning power; lack of money lowers demand for goods and services, and that consequently leads to many bankruptcies.

A study from the United Kingdom confirms the same facts. It is assumed that over 10 million British are at a high risk of being replaced by robots within 15 years. Up to 30% of jobs in Britain are potentially under threat because of artificial intelligence. Sectors such as wholesale and retailing are in peril with around 2.25 millions of workers without jobs; 1.2 million are under threat in manufacturing, 1.1 million in administrative and support services and 950,000 in transport and storage. Education, health and social care are the sectors seen as least threatened by robots because there are tasks that can be hardly automated. At the same time, it is expected that women are not in such danger as men as they tend to work mainly in the health care, education and social sector [10].

Similarly, Martin Ford analyzed the impact of cyber systems and computers on human employment and came to interesting conclusions. He claims that artificial intelligence, automatic machines and software programs will no longer primarily affect low-wage, uneducated workers, but enter as well those working positions that expect studying and education. At the same time, those university educated individuals will be able to perform sophisticated analysis and decision making. He came into conclusion that the result of this development is likely to be structural unemployment that will definitely hit the workforce in nearly all working positions from workers without diplomas to those who have studied and reached the graduate degree [11].

Due to this revolution, the banking sector is in jeopardy as well. The chief executive of Deutsche Bank warns about the impact of technology that will cause the staff to lose their jobs as robots take over. In the future, the banking industry will not need as many people as today. On the other hand, automation might lead to improvement in jobs. For example, it takes an accountant from three to four weeks to produce an account. If a machine could do it faster, then accountants could focus on analysis of results instead[12].

On the other hand, German companies have the contrary approach. Germany is one of the most digitalized countries with 200,000 robots at its disposal; yet, the level of unemployment

reached only 6% in 2016. Obviously, the demand for skilled workers has been changing; laborers are expected to gain new skills and must learn about modern procedures and shift their focus in the new direction. The most modern factory of Siemens EWA in Amberg, for example, has increased its production almost 7 times thanks to robotization, and it has reached the accuracy of 99.9966%, which is the world record within comparable enterprises. What is more, the number of its staff of 1,100 has not changed that much; they have only changed job description. Instead of putting computers together, they focus on development, design and production planning [3].

5 Conclusions

Nevertheless, the risk we are facing in the near future is higher unemployment within certain areas, affecting mainly low-skilled jobs. Obviously, those with high school diplomas and university degrees are not at peace either. The trend to move forward and come with new software, machines and technologies will flourish further, and the incoming job losses must be approached seriously. It is clear that people without jobs cannot produce spending power, and what is more, they put higher pressure on the social system. Money paid to the unemployed must be found somewhere, and this is usually solved through higher tax burden. The task is to think about these threats and to adapt to them as fast as possible in order to ensure a better future for the humankind.

Literature

1. FIŤKOVÁ, D., 2012. *1. priemyselná revolúcia*. [online] Available at: <https://prezi.com/yifujxnvmppo/1-priemyselna-revolucia/> [Accessed 2 September 2017].
2. KRIŠTOFOVÁ, L., 2012. *Tretia priemyselná revolúcia*. [online] Available at: <http://www.jetotak.sk/ekonomika/tretia-priemyselna-revolucia> [Accessed 2 September 2017].
3. JURINA, Ľ., 2017. Nemecký Industrie 4.0 inšpiruje vyspelý svet. *Trend*, 25. pp.10-11.
4. SCHWAB, K., 2016. *Fourth Industrial Revolution*: *what it means, how to respond*. [online] Available at: <https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond>[Accessed 7 September 2017].
5. BAUR, C. and WEE, D., 2015. *Manufacturing's next act*. [online] Available at: <http://www.mckinsey.com/business-functions/operations/our-insights/manufacturings-next-act > [Accessed 10 September 2017].
6. MAAR, B., 2016. *What Everyone Must Know About Industry 4.0*. [online] Available at: < https://www.forbes.com/sites/bernardmarr/2016/06/20/what-everyone-must-know-about-industry-4-0/#b36dd85795f7> [Accessed 10 September 2017].
7. *Industry*: *4.0 will bring unemployement*. 2016. [online] Available at: <http://comebuyinfo.hatenadiary.com/entry/2016/04/13/170830> [Accessed 10 September 2017].
8. MAŤOVČÍKOVÁ, D. a kol. 2013. *Makroekonómia*. *Vybrané state 1st* ed. Bookman s.r.o.
9. RIAGA, O.**,** 2016. *Unemployment in the age of Industry 4.0 – What would you want to become if you didn't have to work*? [online] Available at:

<http://www.kachwanya.com/2016/08/08/the-age-of-industry-4-0/> [Accessed 10 September 2017].

10. ELLIOTT, L., 2017. *Millions of UK workers at risk* of *being replaced* by *robots, study says*. [online] Available at: <https://www.theguardian.com/technology/2017/mar/24/millions-uk-workers-risk-replaced-robots-study-warns> [Accessed 11 September 2017].
11. FORD, M., 2009. *The Lights In The Tunnel*. USA: Acculant Publishing. [online] Available at: <https://ieet.org/archive/LIGHTSTUNNEL.PDF> [Accessed 11 September 2017].
12. TREANOR, J., KOLLEWE, J., 2017. *Deutsche Bank boss says 'big number' of staff will lose jobs to automation*. [online] Available at: < https://www.theguardian.com/business/2017/sep/06/deutsche-bank-boss-says-big-number-of-staff-will-lose-jobs-to-automation> [Accessed 10 September 2017].

Contact data:

Ing. Daniela Maťovčíková, PhD.
Vysoká škola manažmentu v Trenčíne
Bezručova 64
911 01 Trenčín, Slovakia
dmatovcikova@vsm.sk