



FEATURES OF THE FORTH INDUSTRIAL REVOLUTION: TAXES CASE

Valentas Gružas¹, Gita Statnickė^{1,2}

¹ Kaunas University of Technology, ² Klaipėda State University of Applied Sciences, Lithuania

Annotation

The upcoming fourth industrial revolutions causes instability in the society and economy. From one side, the development of robots and artificial intelligence allows automation of business processes, which in result stimulates the growth of the economy. In 2016 an insurance company implemented artificial intelligence for insurance pay-out calculations, which increased the productivity of the company by 30%. From another side, automation increases structural unemployment rate, which causes negative consequences to society. A global market research company McKensey stated that today's technology could feasibly replace 45% of jobs right now. Technological development is inevitable due to rapidly growing population and changing business environment. Without technological development, the productivity could not increase and economic prosperity would be impossible. Moreover, due to required high capital investments multi-national companies can monopolize the industry, leaving small and medium enterprises (SMEs) behind. This problem could be an even bigger concern for the European Union, because today SMEs are the backbone of Europe's economy, which represent 99% of all businesses in the EU. Increased productivity can be achieved by large investments, therefore SMEs losses competitiveness advantage, which causes natural monopolistics to rise. For example, a robotics company "Symbotic" has developed a system to automate warehouse jobs formerly done by humans. The system cut labour costs by 80% and reduced warehouse size by 25%, however the initial investment required more than 74 EUR million. These kind of systems are still expensive, however in future the costs will decrease. These findings indicate the necessity for the government to interfere and to present a tax-subsidy scheme, which would stimulate economic growth and would limit the negative consequences of business process automation. The extra funding should be oriented to the reformation of the current education system and to aid employees during the requalification period.

KEY WORDS: technological change; artificial intelligence; unemployment; tax-payment system; entrepreneurship.

Introduction

The first industrial revolution began in the late 18th century when hand-work shifted to machine work. The innovations, which stimulated the first industrial revolution, included energy sources used for machines such as water and coal. One of the key industries at that age was textile, which due to mechanised cotton spinning greatly increased productivity. The second industrial revolution began from 1840 when steam engines were invented. Steam engines increased efficiency of energy consumption by 10 times, which in result greatly decreased production costs and maximized productivity. The industrial revolution also lead to the development of machine tools, which provided the ability to process metal. More advanced processes to use natural resources caused even more growth of the economy. The most common production processes were job-shop and batch production before the second revolution. Due to technological innovations, mass production was introduced to the market, which again revolutionized the industry by lowering costs. Even greater efficiency was achieved, when plastic was invented, which decreased the production costs even furtherly. The third industrial revolution began in the 21st century (Allen 2014).

The third industrial revolution began, when information technologies were invented. The information technologies (IT) allowed transaction costs to be reduced. Ronald Coase published a paper in 1937 titled "The nature of the firm". He predicted the rise of multi-national companies by amplifying the scale of economy concept as a competitiveness advantage to reduce costs (Coase 1934). However, at that time it was necessary to have one accountant for three employees, which raised the transaction costs drastically. Due to the invention of IT, transaction costs were reduced dramatically, which even today is causing a rise of small and medium enterprises (SMEs). For example, SMEs are the backbone of Europe's economy, which represent 99% of all businesses in the EU (Commission 2014). These technology development trends is leading to the fourth industrial revolution, which is characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres. Artificial intelligence (AI) and robots are the main technological innovations, which stimulate the appearance of the fourth industrial revolution. The ability to gather information from physical world, to process it and based on the outcome allow a computer-based system to make decisions instead of people, is revolutionizing the world's economy. However, these tendencies are causing many disputes in the world. On one hand, the fourth industrial

revolutions allows businesses to automate their processes. However, high capital investments is required to implement such technologies in businesses activities, which is causing SMEs to loose competitiveness advantage against large multi-national companies. On the other hand, higher productivity results in higher unemployment rate, which causes negative consequences.

Therefore, the government must implement a tax-subsidy scheme for business process automation to promote economic growth. Later, after the return of investments, oblige the participants to pay extra taxes to limit the negative affect of automation such as decline of job positions, mismatch of labour market skills and other social consequences. To amplify the proposed methodology several objectives must be accomplished:

1. Identify the fourth industrial revolution impact to economic growth;
2. Analyse the consequences of the fourth industrial revolution to social and business environment;

3. Propose a tax-subsidy scheme to minimize the negative effect of the fourth industrial revolution.

The impact of business process automation to world's economy

Technological development has drastically effected the productivity of the world's economy. World Bank statistics indicated that in 1960 – 2015 period the gross domestic product (GDP) per capita increased 60 times (The World Bank 2017). Further technological development will accelerate the economic potential even more. Greg Becker, the president of Silicon Valley bank, stated that when the population size will reach 11 billion, the value-added for the whole world to exist will be generated by less than 1 billion work force, while others will live from government aid. Rapid growing technologies will impact various sectors, part of them has been already effected due to the 3rd industrial revolution (see figure 1).

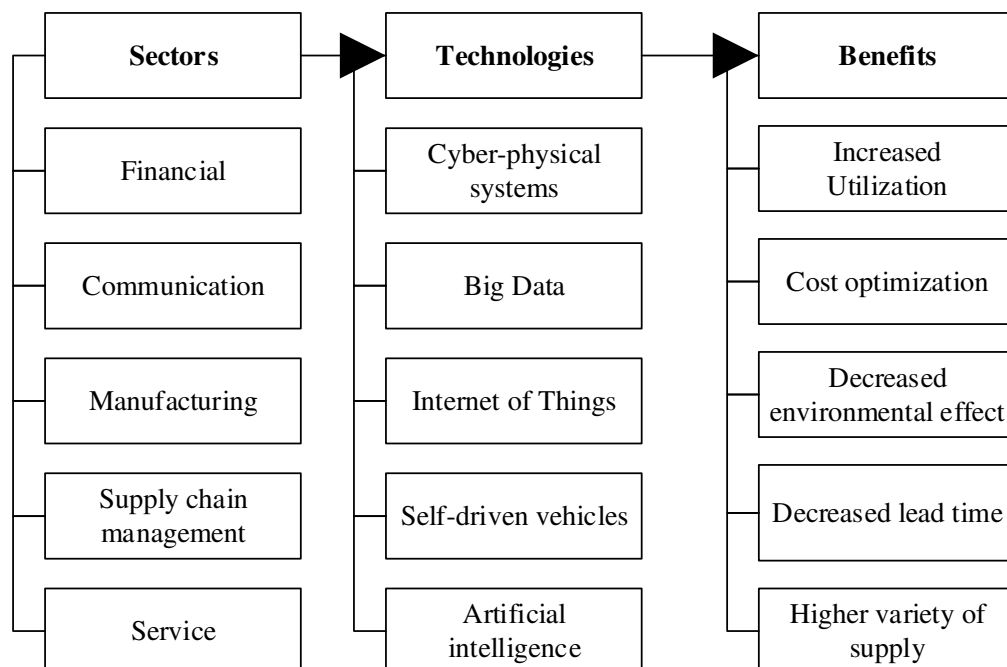


Fig. 1 The Fourth Industrial Revolution Influence to Economic Sectors

Financial sector due to the speed of information and money has drastically changed. Credit cards, international transfers rapidly stimulated the economic growth. Moreover, the insurance sector also adapted to the new technologies, which increased the productivity of sales. In the future, the FinTech industry will be impacted even more due to the fourth industrial revolution. Communication sector, which before mainly involved letters and phone calls also drastically changed. Today the transaction costs were reduced practically to zero due to computers and worldwide access to internet. Today there is still a problem with language barrier, which is being research due to more advanced computational possibilities such as natural language processing. The development of new technologies has drastically influenced the industry also. Production processes has changed from mass production to flexibility and the

defect rate has been reduced drastically. Today the main problem lies in increasing the resilience of the system to implement fully 100% no defect rate policy, which still has been difficult to succeed. Supply chain management changed to high visibility of the whole processes, which improved decision-making. However, the delay of making decisions is still low because of human involvement. Due to the fourth industrial revolution, the information utilization possibilities will increase even more. Lastly, the least effected sector today is service industry. However, soon robotics will be implemented to even furtherly increase productivity of the economy. The transport sector will be also drastically effected due to development of self-driven cars, which will decrease parking places and improve the utilization of cars, which today often are not utilized effectively. The internet of things concept has influenced the appearance of smart

cities, which will improve the routing of transport in the cities and decrease traffic jams and other problems, which especially mega cities are facing today. The book industry today has also drastically changed due to the appearance of internet and digitalization of media, in the past book industry had huge fixed cost and today it is possible to publish quite cheap and fast via the internet, which causes drastic change in traditional brick type stores. A similar situation can be seen in the news industry, where information is spread across social media and other channels much faster than traditional ones. The internet has also drastically influenced the education sector, because of the appearance and rapid growth of online lectures, which are interactive and does not require students to travel long distances. Moreover, real-estate is also not needed any more, which reduces the fixed costs of education drastically. The digitalization of the industry changed the entertainment and sport sector as well. A few decades ago the online game industry was not so popular and now it is being treated the same as traditional sports. Lastly, all the consumers buying habits changes due to the trend for e-commerce. In the past consumers bought in the shops just what they could, today they can order through the internet from any place of the world, choosing from huge variety, which causes drastically changes in competitiveness environment. These trends are mainly due to the third industrial revolution. New technologies will even more effect the mentioned industries and sectors.

Artificial intelligence (AI) is contributing the most to these trends, which causes many disputes in the market. AI has enabled businesses to increase productivity and profitability dramatically. For instance, in 2016 an insurance company implemented AI for insurance pay-out calculations, which increased the productivity of the company by 30%. The initial capital investments required

170 EUR million and will save 1.1 EUR million early (BBC 2017). Another unique usage of AI in financial sector is related to high frequency trade (HFT). HFT involves complex algorithms, which estimates stock prices and executes high quantity of transactions through multiple markets. HFT might seem futuristic, however in 2008 a start-up company “Virtu financial” was established, which currently operates on more than 235 markets in 36 countries. It was reported that by March of 2014, the company made profit 1,277 out of 1,278 days, while losing money just one day (Bloomberg 2014). AI has effected not only the financial sector, but the industrial as well. A new concept of cyber-physical systems (CPS) emerged, which is an integration of computation, networking, and physical processes (Ray 2017). The growth of productivity will be stimulated even more by the appearance of CPS, however the possible potential of this concept is still unclear. In 2013, the European commission indicated that CPS economic and social potential is much larger than anticipated (Commission 2013). For instance, a robotics company “Symbotic” has developed a system to automate warehouse jobs formerly done by humans. The system cut labour costs by 80% and reduced the warehouse size by 25%, however the initial investment required more than 74 EUR million (The Wall Street Journal 2016). Another key aspect of the industrial sector is transportation. The development of self-driven trucks will impact the productivity of the economy also. One of the largest distribution company’s DHL indicated that self-driven vehicles will be able to travel 24/7 without requiring driver rest time and, compared with today’s driving, could achieve overall cost reductions in the region of 40 % per kilometre (DHL Trend Research 2014).

Table. 1. Share of Total Global R&D Spending (Bernstein 2016)

	2014	2015	2016
North America	29.10%	28.50%	28.40%
U.S.	26.90%	26.40%	26.40%
Caribbean	0.10%	0.10%	0.10%
All North America	29.20%	28.50%	28.50%
Asia	40.20%	41.20%	41.80%
China	19.10%	19.80%	20.40%
Europe	21.50%	21.30%	21.00%
Russia	3.10%	2.90%	2.80%
South America	2.80%	2.60%	2.60%
Middle east	2.20%	2.30%	2.30%
Africa	1.00%	1.10%	1.10%
Total	100.00%	100.00%	100.00%

Table 1 indicates total global spending to R&D by region and main countries. In 2014 the Global R&D spending was 105,8 billion USD, the 2015 estimation is 107.8 billion USD and the forecast in 2016, 112 billion USD. The trend indicates increasing expenditures to innovation development stimulating the economic growth. These facts indicate that artificial intelligence is

stimulating the growth of the economy, however, at the same time, is causing negative consequences.

The necessity to adapt to the fourth industrial revolution

AI not only influences the growth of the economy, but also causes unemployment to increase. The world economic forum estimated that by 2020 five million jobs will disappear due to technology development (World Economic Forum 2016). Another, research indicated that 10 million job positions will be destroyed in USA by 2025 due to self-driven vehicles (Business Insider 2015). A global market research company, McKensey, stated that today's technology could feasibly replace 45% of jobs right now (McKinsey 2015). In 2016, President Barack Obama of the US, warned Congress about the threat of job loss, based on several reports that found that as much as 50% of jobs could be replaced by robots by 2030 (Insider Business 2016). These issues can be limited by government interference, however there is a lack of policy and understatement of how to deal with these issues effectively.

The development of AI can crush millions of job positions, however it will also influence the appearance of new job positions, which were not possible in the past. The economy tendencies are best summarized by "the parable of the fish" by a world-class economist, Paul Zander. The story explains that in a small island people used to fish with a rod, however an innovation was introduced – a net. The appearance of the net increased the productivity by 80%, which in result increased the unemployment rate by 80%, since there were only 10 anglers in the island (Zander 2007). High unemployment rate does not contribute to the bankruptcy of the island. The unemployment growth simply identifies the necessity for the labour market to shift their skills to new occupations such as farming, sewing and so on. This concept is called structural unemployment, which is a mismatch of the labour market skills and the demand of the market. The current educational system is too slow to teach the labour market new skills and it cannot cope with the growth of technology (The Chronicle of Higher Education 2016). The household and student loan debt statistics of US can identify the ineffectiveness of the education system. The report of Bank of New York indicated that in 2016 the household debt doubled since 2004 to a value of 11.58 EUR trillion, with 1.21 EUR trillion consisting of student loan debt (Federal Reserve Bank of New York 2017). These statistics indicate that new graduates are unable to earn money and returns debts. Therefore, the government must introduce a tax-

subsidy scheme to stimulate economic growth, since implementation of AI requires large capital investments. Later, after the ROI, the companies should be taxed more to soften the lag between labour market skills and market demand.

Elon musk, founder of Tesla, is promoting a similar approach, which is called universal basic income (UBI) (Business Insider 2017). UBI is government aid, which is a fixed payment to people, since technology will generate all the value-added instead of people. However, the implementation of UBI can cause the labour market to stop evolving, therefore the government aid should not be simply distributed between the labour market. The extra taxes should be oriented to the education system reformation. Part of the extra funding should be oriented to programming skills and engineering. The UBI should be paid during the requalification period, while the employees gain enough knowledge and could offer themselves to the market again. However, Mark Cuban stated that the automation of automation is arising due to AI development. Computers will learn how to write software better than humans can. Mark Cuban also identified that the most on demand labour skill will be "creative thinking" (The Times 2017). The skills on demand will also involve leadership, relationship management, and public speaking, entrepreneurship – specifically the necessity to create communities or networks. In the past entrepreneurship was considered as something unique, today it is necessary in order to survive in the technology-effected economy. One of the best network creation example is network marketing or multi-level marketing (MLM), which due to rapidly developing technologies gained even more recognition. Robert Kiyosaki, a best-selling author and entrepreneur, indicated that MLM is a way for the average person to generate wealth, which involves mentorship, financial gain and the opportunity to learn specific skills (Fleming & Kiyosaki 2010). Paul Zander in his book "The Next Millionaires" stated that the economy shifted from production and logistics to information distribution, where MLM stands to gain the most out of this opportunity (Zander 2007). Frank Feather (Feather 2002) and Bill Quain (Quain 2008) also amplifies the future consumer trend. They amplify the internet impact to business operations and identifies that consumers will start shopping where there are additional value added and is a possibility to earn profit through spending and expanding networks.

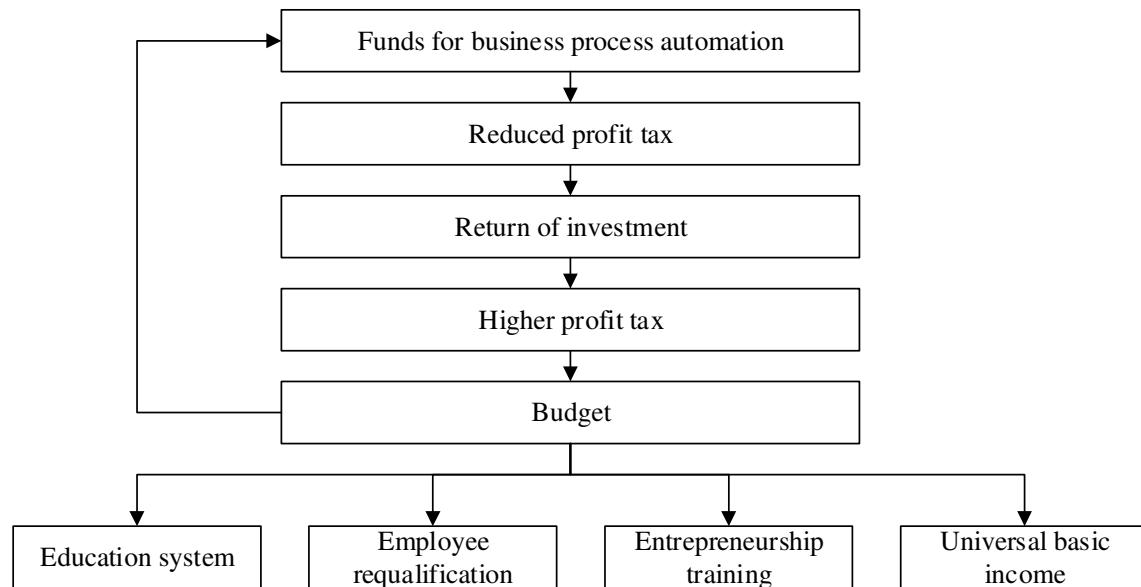


Fig 2. Tax-subsidy scheme

Figure 2 represents the proposed tax-subsidy scheme to limit the negative consequences of the fourth industrial revolution. Companies should apply to a fund to receive capital for business process automation. During the period while the system does not return profit, a reduced profit tax should be applied to the company. After the period of return of investment ends a higher profit tax should be applied, which would be distinguished in to main five areas. Firstly, the same fund should be refinanced to increase the subsidy coverage. Other area of investment should be oriented to recreation of the educational system, which is lagging to provide necessary employee skills to the current market demand. So these funds should be used for infrastructure expenditure and welfare for the unemployed, however this payment is only for those who decide to adapt their skills to a new profession. A similar budget part is entrepreneurship, however it focuses on mentorship and teaching people how to operate personal businesses. Lastly, the universal basic income would be paid to those who cannot adapt to a new position or does not have the ambition to build their own business. These people would receive their payment only by contributing to society in other possibilities ways like environment, culture, entertainment and so on.

Conclusions

Rapid technology innovations has drastically influenced the economy, which in result caused instability in the labour market. On one hand, businesses need extra funding since technology implementation in their processes require high initial investments. On the other hand, the analysis indicated that innovative technologies will cause many jobs to disappear from the market and will generate new occupations, which were not possible in the past. Therefore, the government must introduce a tax-subsidy scheme to stimulate economic growth and limit the negative effects of rapid growth of productivity. The payment of universal basic income (UBI) is necessary to soften the lag between market demand and labour market's requalification period.

The education system must be reformed to teach not only programming and engineering skills, but also provide leadership, public speaking, creative thinking and other necessary traits, which are essential to survive during the upcoming fourth industrial revolution.

References

- Allen, R.C. (2014). The British Industrial Revolution in Global Perspective: How Commerce Created The Industrial Revolution and Modern Economic Growth. Unpublished, pp.1–41. [revised 2017-08-15], <http://papers3://publication/uuid/081AED1F-F9E8-4654-B321-F739DC40358E>.
- BBC (2017). Japanese insurance firm replaces 34 staff with AI. [revised 2017-08-23], <http://www.bbc.com/news/world-asia-38521403>.
- Bernstein, E. (2016). 2016 GLOBAL R & D Message from the IRI President. R&DMagazine.
- Bloomberg (2014). Virtu Touting Near-Perfect Record of Profits Backfired. [revised 2017-08-30], <https://www.bloomberg.com/news/articles/2014-06-04/virtu-to-uting-near-perfect-record-of-profits-backfired-ceo-says>.
- Business Insider (2017). Elon Musk doubles down on universal basic income: "It's going to be necessary". [revised 2017-08-17], <http://nordic.businessinsider.com/elon-musk-universal-basic-income-2017-?r=US&IR=T>.
- Business Insider (2015). How Uber's autonomous cars will destroy 10 million jobs and reshape the economy by 2025. [revised 2017-09-04], <http://www.businessinsider.com/ubers-autonomous-cars-destroy-10-million-jobs-reshape-economy-2015-2?r=US&IR=T&IR=T>.
- Coase, R.H. (1934). The Nature of the Firm. Economics.
- Commission, E. (2013). Cyber-Physical Systems: Uplifting Europe's Innovation Capacity. Report from the Workshop on Cyber-Physical Systems, (December).
- Commission, E. (2014). Small Businesses First.
- DHL Trend Research (2014). Self-Driving Vehicles in Logistics, Troisdorf.
- Feather, F. (2002). Future Consumer.com.
- Federal Reserve Bank of New York (2017). Household Debt Increases Substantially, Approaching Previous Peak. [revised 2017-09-08], <https://www.newyorkfed.org/newsevents/news/research/2017/rp170216>.
- Fleming, J. & Kiyosaki, R. (2010). The Business of the 21st Century.

- Insider Business (2016). Obama just warned Congress about robots taking over jobs that pay less than \$20 an hour. [revised 2017-08-11], <http://www.businessinsider.com/obama-warns-congress-about-robot-job-takeover-2016-3?r=US&IR=T&IR=T>.
- McKinsey (2015). Four fundamentals of workplace automation. [revised 2017-08-12], <http://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/four-fundamentals-of-workplace-automation>.
- Pilzer, P.Z. (2007). The New Wellness Revolution: How to Make a Fortune in the Next Trillion,
- Quain, B. 2008. Pro-Sumer Power,
- Ray, L. (2017). Cyber-Physical Systems: An Overview of Design Process, Applications, and Security, IGI Global.
- The Chronicle of Higher Education (2016). MIT Dean Takes Leave to Start New University Without Lectures or Classrooms. [revised 2017-09-05]: <http://www.chronicle.com/article/MIT-Dean-Takes-Leave-to-Start/235121/>.
- The Times (2017). Mark Cuban Says This Will Be the No.1 Job Skill in 10 Years. [revised 2017-08-22], <http://time.com/money/4676298/mark-cuban-best-job-skill/>.
- The Wall Street Journal (2016). Fully Autonomous Robots: The Warehouse Workers of the Near Future. [revised 2017-09-02], <https://www.wsj.com/articles/fully-autonomous-robots-the-warehouse-workers-of-the-near-future-1474383024>.
- The World Bank (2017). GDP statistics. [revised 2017-08-27], <https://data.worldbank.org/indicator/NY.GDP.PCA.PD>.
- World Economic Forum (2016). Five Million Jobs by 2020: the Real Challenge of the Fourth Industrial Revolution. [revised 2017-08-03], <https://www.weforum.org/press/2016/01/five-million-jobs-by-2020-the-real-challenge-of-the-fourth-industrial-revolution/>.

RECEIVED: 25 August 2017

ACCEPTED: 10 October 2017

Valentas Gružasuskas received bachelor degree in “Applied Mathematics and Economics” in 2014, master degree in “Industrial Engineering and Management” in 2016 and since September, 2016 started studying PhD in management science. The main research area is operation research in logistics with a focus on logistic cluster development and innovative technology usage. Due to mathematical background, Gružasuskas focuses on quantitative analysis by conducting simulations, stochastic and dynamic models and other analytical approaches to amplify the developed theories. Gružasuskas also is working as a freelance data analyst with a focus on statistical analysis, web scraping and machine learning. Kaunas University of Technology, PhDc, Valentas Gružasuskas. E-mail: Valentas.gruzauskas@ktu.lt.

Gita Statnickė. Lecturer, Klaipeda State University of Applied Sciences, Lithuania; PhD student of Management, Kaunas University of Technology, Lithuania. Field of scientific research: Human resource management, Entrepreneurship. E-mail: g.statnicke@kvk.lt.