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Robots as Job Killers, the End of Work Myth – a Case Study from Slovakia

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Abstract

According to our results, Slovakia faces a particularly high risk of potential automation of existing jobs, especially at lower education levels, compared with an above-average education sample. Further, professions that require a high degree of analysis and interaction, as well as problem-solving skills (teachers, doctors, scientists, lawyers, social scientists, managers and directors) show high proportions of employees with a lower risk of automation. Moreover, occupation groups that involve simpler and more routine activities and have lower formal qualification levels, such as unskilled workers, cleaning staff, cashiers, craftsmen, metal- and mechanical workers, machine operators and to some extent service staff, include a high proportion of employees facing a higher risk of automation. By sector, there are a large number of employees with a high risk of automation (> 60%) in the automotive, manufacturing, wholesale and retail, construction and hospitality industries. In addition, women are likely to be affected most by the implementation of automation and AI.

Keywords: Robots in workplace, digitisation, automation, Work 1.0 to Work 4.0

INTRODUCTION

Reluctance to leave one's work for fear of being replaced by machines/robots is not a new phenomenon of the fourth industrial revolution, but a recurring theme in economic history (e.g. "Luddite rebellion" (Luddites, n.d.) and "machine storm" (E-periodica, n.d). Automation is changing the way we work. Digitisation shapes the modern world of work. After mechanisation (Industry 1.0), mass production (Industry 2.0), automation (Industry 3.0), we are now in the stage of Industry 4.0 with the Internet of Things and services. The Internet changes our concept of work and also the role of humans in the economy. Since 2011, "4.0" is summed up as the upheaval of the digital transformation (Klitou et al., 2018).

Cixin (2016) emphasises that "the robot revolution will be the quietest one", and it is attracting the attention of policymakers, employees and the media. Many publications in the 21st century warn against job losses as a result of the digital transformation (Frey and Osborne, 2013; Manyika et al., 2017). The latest data from 2018 show that about 14% of jobs in OECD countries are highly

automatable, 33% of all jobs in Slovakia are highly automatable, and the average worker in Slovakia has a 62% probability of being automated, the highest percentage in OECD countries (Nedelkoska and Quintini, 2018).

In our paper, we focus on Slovakia. Firstly, Slovakia has a high robot density; it ranks 17th worldwide and comes second after only Slovenia in the Eastern bloc (IFR, n.d.). Secondly, it is convenient for purely practical reasons. This study focuses on the question of whether robots will steal jobs in Slovakia or not. Further, we try to find an answer to the question of whether automation will be good or bad for women. The next question respondents were asked is: Will robots take over human activities within the next 50 years? Our data are based on a systematic literature review and email questionnaire results. In the next section, we describe the methodology used in our analysis. The third section explains the evolution of the working world from Work 1.0 to Work 4.0. We present and discuss our results in the fourth part. The paper ends with our discussion and final remarks.

METHODOLOGY

We carried out a two-step research project to study our topic. The first step was a literature review on the extent of the evolution of the working world. To understand this phenomenon, we evolved a simple linking scheme that can be applied to the timeline of the four industrial revolutions based on the white paper Work 4.0 from the German Federal Ministry of Labour and Social Affairs (Nahles, 2015). Each historical industrial timeline created an organisation of work that addressed its needs. The second was a questionnaire survey in which we emailed questionnaires to employees in different sectors in Slovakia. The employees had different education levels, but there was gender equality (men/women). This combination of instruments allows a clearer understanding of the meaning and/or content of the results presented in our study.

The data used in this study were collected from mid-February to mid-March 2019, with a probability sample of 800 Slovak employees. There was a response rate of 40.0%, in which 50.0% of the subjects were female and 50.0% male. The survey data were coded, so that it is possible to determine the type of respondent, including age, gender, living environment, occupational group and education level, as shown in Figure 1. Unemployed people were excluded in the pre-survey. We used codes as control variables in the analyses.

Figure 1: Detailed characteristics of respondents (N= 800).

Characteristics	Percentage	Characteristics	Percentage	Characteristics	Percentage
Age		**Gender**		**Educational level**	
15-29 years	16.62	male	50.00	apprenticeship	14.75
30-39 years	21.00	female	50.00	technical college	13.75
40-49 years	30.13			high school	27.38
50-59 years	26.13			university	19.75
>60 years	6.12			only primary education	24.37
Occupation group		**Living environment**			
executive		city/town	81.13		
academic	6.43	country	18.87		
technician	16.54				
office worker	21.60				
service occupation	11.60				
craftspeople	17.14				
machine operator	12.49				
unskilled labour	6.40				
	7.80				

Author's own elaboration.

The email questionnaire contained several types of questions for respondents to answer. Some questions were open-ended, which allowed respondents to submit their own answers.

EVOLUTION OF WORKING WORLD FROM WORK 1.0 TO WORK 4.0

Technical advances change the way humans work and produce objects in the different industrial revolutions. The rapid evolution of labour-saving devices, the development of transport, the discovery of electricity, and the introduction of the telegraph and the Internet are well-known achievements of the industrial revolution (IR). A further sign of this positive process was the rise of special professions needed for each period of IR, with more specialisation and the rapid expansion of cities and towns. At the beginning, the workers have poor working conditions, and their safety and wages are considered to be less important issues. During the 20th century, child labour was virtually eliminated, working days were reduced and safety standards were guaranteed by government. The present century is characterised by greater flexibility and work/life balance.

Therefore, Work 1.0 refers to the beginning of the first IR society and the first workers' movements and organisations. With the modern inventions of this period not only production methods, but also the organisation of work, social structures and the self-image (understanding) of the developing classes changed (Nahles, 2015). In 1825, the average working time was a seven-day week of 82 hours (Strawe, 1994). Generally, working conditions during this period were very bad, because of danger resulting from underdeveloped technology, lack of safety and no protection for workers. The era is distinguished by cheap labour, unskilled workers, bad environment/health conditions and child labour (Industrial Revolution Working Conditions, 2018; Poddar, n.d.).

During Work 2.0, factories took full advantage of human labour, but paid scant attention to workers' rights (Lewis, n.d.). However, the working week was reduced to six days, and working hours showed a general downward trend, e.g.– 60 hours a week in 1900, 57 hours a week in 1913,– 8 hours a day in 1918,– 42 hours a week in 1932,– 50 hours a week in 1941, 48 hours a week in 1950 (Strawe, 1994). Work 2.0 had far-reaching social effects, e.g. the place of work shifted from the home to the factory, workers were required to follow a routine schedule, the pace of work, driven by machines, increased dramatically, and the health of workers declined because of poor working conditions (Lewis, n.d.).

Work 3.0: this era already includes the consolidation of the welfare state and workers' rights through negotiation on the basis of the social market economy. Sharing common interests is becoming important, including the partial withdrawal of social rights. Since the 1980s, the share of services has increased rapidly, and national markets are opening up to the world as a result of globalisation and organisations such as the European Union (Nahles, 2015). Since 1956, the working week has been reduced to five days. The work week was 40 hours in 1965, 38.5 hours in 1984 and 35 hours in 1995 (Strawe, 1994). Work in this period was arranged by the traditional hierarchical model, and Morgan (2013) highlights the following features: fixed working hours, hoarded information, fear-based leadership, on-premises technology, email as the primary form of communication and working in cubicles.

Work 4.0 is and will be more connected, digital and flexible. Increased networking and growing cooperation between human and machine not only changes the way we produce and how we work, but also creates modern products and services. Social and cultural change creates new demands on work and the workplace (Nahles, 2015). Since 2005, the normal working week has ranged from 35 to 48

hours, with the 40-hour week being the customary standard (Lee et al., 2007). Modern organisations are adopting a more flattened approach with mutual interaction, compared to the traditional hierarchical model. In addition, there is a greater prevalence of flexible working hours, so that the worker is connected anywhere, at any time and on any device, the sharing of information through different platforms, workers being empowered and inspired by smart leaders, the use of cloud technology and an increase in modern collaborative technology allowing workers to cooperate, share, search, communicate and engage with people and information (Morgan, 2013). According to the report Work 4.0 (Nahles, 2015), this latest era denotes integrated working, growing interconnectedness and a rise in cooperation between man and machine, all of which is indicative of a shift in values and a new social compromise since the beginning of the 21st century.

RESULTS

Various publications in the 21st century warn of job losses due to the digital transformation (Frey and Osborne, 2013; Fujitsu, 2018; Valsamis et al., 2018; WEF, 2016). The McKinsey report (2017) predicts that by 2030 as many as 800 million jobs could be lost to automation worldwide. The report states that, as in the past, technology will not be a purely destructive force, because new jobs will be created, exiting roles will be redefined and workers will have the opportunity to switch careers.

According to the OECD's Job Creation and Local Economic Development report of 2018 (OECD, 2018a), the risk of automation is much higher in some regions than in others within countries, while Slovakia ranks as the most vulnerable OECD country. The International Robotics Federation ranked Slovakia as the world's 17th largest robot market in 2017 (IFR, 2018).

A total of 57% of Germans expect that digitisation will not have a major impact on their jobs, compared to 27% who think it will have a high impact (Schmidt, 2016). According to the data from a 2017 survey in the EU (Ec.europa.eu, 2017), three quarters of Europeans said that digitisation was good for the economy and for society, whilst the same proportion of participants thought that it would destroy more jobs than it creates. A 2018 Accenture report, "Reworking the Revolution" (Accenture, 2018), estimates that by 2020 new applications of AI combined with human collaboration could boost employment worldwide by as much as 10%. David (2015) points out that automation replaces labour, but it also complements labour and increases output in ways that lead to a higher demand for labour.

The purpose of this study was to examine the potential of automation in Slovakia. Participants in our study were asked to state the extent of probability that parts or the entirety of current jobs could be replaced by machines in the future. Further, we analysed the gender resistance of AI and automation. Additionally, respondents were asked how likely they thought it is that robots will take over most human activities within the next 50 years. In other words, the focus is on possible job losses in the context of further digitisation and automation.

Frey and Osborne (2013) estimate that automation and digitisation will primarily affect workers with lower levels of education, and this has been confirmed by the results of our survey. Closer analysis of the level of education in our sample shows no statistical correlation between the highest level of education and the estimated probability that parts or the entirety of jobs will be replaced by machines in the future. On the contrary, those who do not have any education tend to be more afraid of being replaced by machines, compared with those with a university degree. Workers who have completed their education/training (apprenticeship, college or high school) but have not graduated from an

institution of higher education tend to be less afraid of being replaced by machines compared with those with only primary education. See Figure 2. This is probably as a result of the demands of the labour market and diversification of job positions and also the industrial sector.

Figure 2: How much do you estimate the probability that parts or the entirety of current jobs will be replaced by machines in the future?

Education level	high	rather high	rather low	low
university degree (N=158)	0%	1%	36%	63%
only primary education (N=195)	64%	32%	2%	2%
apprenticeship, college, high school (N=447)	15%	19%	36%	30%

Author's own elaboration.

In the main occupational groups, the following show a high degree of automation risk: primary workers (skilled and unskilled) – 66%; craftsmen – 55%; metal- and mechanical workers – 61%; machine operators – 63%; and (to a lesser extent) service occupations (cashiers – 69%; receptionists – 49%; couriers – 54%; proofreaders – 58%' telemarketers – 72%). We assume that any job that is routine or monotonous runs the risk of being automated.

Professions that require a high degree of analytical and interactive activity, mutual cooperation and problem-solving skills show a high proportion of employees in the lower automation risk area. These are teachers – 0.55%; health professionals – 0.65%; scientists – 0.80%; lawyers – 0.95%; social scientists – 1.30%; business executives – 1.4%; managers and directors (HR, sales, marketing, PR) – 1.5%; writers – 3.8%; editors – 5.00%; and graphic designers – 8.2%. But in the future, with the help of technology, the ratio of employees in these occupations could be decreased due to automation – for example, where 20 teachers are required now, only a few would be required to do the same work.

By sector, a large number of employees (> 60%) in the automotive, manufacturing, wholesale and retail, construction and hospitality industries face a high risk of automation.

Men and women often work in different jobs and sectors and are affected differently by technological change. Women made up 45.54% of the total labour force of Slovakia in 2018 (Worldbank, n.d.), but, according to our data, Slovakian women face the higher risk of losing their jobs to automation (58%). The risk of job substitution varies by industry sector and education level. In contrast, women workers are also the majority (32%) in jobs the least likely to be replaced by technology, such as child care, care of the elderly, nursing and teaching. These kinds of occupation, with non-routine emotional interaction, are difficult to automate. The lowest-risk occupations require at least a high school certificate or a bachelor's degree. Automation affects women the most across better- and lower-paid jobs.

The respondents were also asked how likely they thought it was that robots would take over most human activities within the next 50 years: 23% feel this to be very likely, 32% believe it to be somewhat likely, 24% feel it not very likely, and 21% are not sure. There were no significant differences by demographic group or living environment. People aged 30 to 49 were slightly more inclined to believe this will be very likely. The biggest groups to say this is not very likely to happen were males and older individuals.

Our results confirm that both automation and digitisation have a significantly negative impact on workers' fears of job losses and the creation of new jobs. The probability of automation for low-skilled workers and low earners is relatively high. There is also likely to be a shift in the importance of the different economic sectors as a place of employment, as happened in the mechanisation and electrical revolutions. Until 2000, agriculture was the mainstay of employment around the world, accounting for 36% of jobs; in 2018, this figure was only 26%. Employment in the services has risen from almost 34% in 1991 to 51.71% in 2018, while at the same time the role of agriculture has declined (Employment in agriculture & Employment in services, n.d.; FAO, n.d.).

DISCUSSIONS AND CONCLUSIONS

These days some jobs disappear, some are regenerated and new ones are created. What are the implications of the developments towards Work 4.0 (Industry 4.0) for further employment? The participants in our study agree that employment opportunities, especially for low-skilled persons in routine or monotonous work, face a high risk of being automated. There are therefore both winners and losers in the digitised work environment. Will continued automation be good or bad for women? A possible answer is that it depends on different aspects, as shown in the results of our study.

This paper has examined the topic of whether robots will take over people's jobs in Slovakia or not, and it provides important information for the future. The paper also examines the role of gender in the risk of automation.

Automation, robots and artificial intelligence have the potential to cause job losses, but certain jobs will also remain. As shown by our results, the automotive, manufacturing, wholesale and retail, construction and hospitality industries are particularly threatened (> 60%). This confirms the latest data from OECD, where Slovakia is shown to face the highest risk of automation (> 70%) (OECD, 2018b).

It appears that workers in low-skilled jobs with low wages have the greatest risk of being replaced, but those doing complicated jobs of a routine nature are also at great risk of losing jobs to a machine. This is confirmed by a 2016 study that low-skilled occupations are generally most at risk (Arntz et al., 2016). Professions that require a high degree of analytical and interactive activity, mutual cooperation and problem-solving skills show high proportions of employees in the lower automation risk area. But in the future, with the help of technology, the ratio of employees in these occupations could be decreased due to automation – for example, where 20 teachers are required now, only a few would be required to do the same work. We believe that the secure types of jobs are those that are free from pattern matching, but require creativity, mutual cooperation and improvisation.

Our results suggest that the past revolution has been positive for women, but the impact of automation and AI going forward shows gender inequality. Slovakian women are more likely to be replaced by robots and might even lose the benefits of automation. Compare this with the OECD study of 2016, which shows that, after controls for a variety of factors, the risk of jobs becoming automated is significantly lower for women than it is for men (Arntz et al., 2016). Another recent contribution (Krieger-Boden and Sorgner, 2018) compares the risks of digitisation of jobs across eight advanced economies (Germany, France, United Kingdom, Italy, Russia, Turkey, Japan and Korea) and reaches the same results, except for Japan where the risk of digitisation for men is significantly lower.

Reluctance to leave one's work for fear of being replaced by machines/robots is not a new phenomenon of the fourth industrial revolution, but a recurring theme in economic history. According to our results, 55% of adults believe that within 50 years robots will have advanced to the point of being able to perform activities done by humans today. Automation seems to be changing occupations in a way that benefits our society, that is for men and women. It must be emphasised that this tool will not eliminate any form of gender gap or fear in the labour market. Automation and AI most probably do result in large gains for society, but, as in other structural changes, not all members of society will profit from them. The technologies of the future will undoubtedly eliminate specific jobs and occupations, but not work itself.

Overall, the previous analysis shows the potential for destruction of certain jobs through digitisation and the automation of employment. If activities are automated in the course of digitisation, there will inevitably be a reallocation and redistribution of gainful employment. Part of the employment relationship will not remain in its previous form, but, as the past has already shown, the integration of modern technologies into the work environment can also create new areas of activity and jobs that will mesh differently with gender and education.

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