TECHNOLOGICAL UNEMPLOYMENT: WHO IS AFRAID OF LOSING THEIR JOB TO A ROBOT?

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ABSTRACT

Objective: The study aimed to identify, analyse and assess the mood regarding the possibility of employees losing their jobs and being replaced with robots and regarding methods of preventing technological unemployment.

Methodology: In March 2021, an online survey of a group of economically active adults in Poland (N=158) was carried out. Using the Internet, the standardised survey was addressed to people selected by the author.

Results: The research has shown that employees are not afraid of losing their jobs, yet almost 90% of respondents plan to increase their competencies. People in managerial positions focus on developing cognitive and social competencies, while people in other positions plan to develop technical competencies.

Research limitations: The research did not include unemployed and digitally excluded people. The research sample was selected by the author. Therefore, we do not extrapolate the results to the general public.

Practical implications: The study shows that employees do not yet fully perceive the problem of technological unemployment. However, when planning their development, they learn independently or choose courses. Low interest in developing competencies in studies may signal that universities should make changes in their pedagogical offering.

Novelty: Most research in the field of technological unemployment deals with the description of a business phenomenon or perspective. There is relatively little research on attitudes and reactions of human capital to the phenomenon of technological unemployment.

Keywords: technological unemployment, competencies, human capital, Industry 4.0

Classification: research paper

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INTRODUCTION

At the beginning of the 21st century, we entered Industry 4.0, initiated by the universality of the Internet. Industry 4.0 is characterised by constant change – new applications are introduced continuously. Development periods and products have also been significantly condensed, and products and services are more and more personalised (Lasi *et al*., 2014). Therefore, the market uses data on a massive scale, and the data is processed during very complex operations, such as artificial intelligence using machine learning (Angelopoulos *et al*., 2020). Thus, robots are starting to enter factories and the service sector. China remains the leader among autonomous robots, while Poland ranks 14th among the countries with the highest robot sales; according to the World Robotics 2020 report, 2,600 of them were installed in 2020 (IFR, 2020). Such results suggest that Poland is developing and investing in robotics. The increase in the number of robots in industry and services may reduce jobs for people – a threat of technological unemployment.

In 2020, we observed a massive increase in the use of technology in everyday work. Researchers and market analysts raise the topic of technological unemployment (replacing people with robots). Only a few publications analyse technological unemployment from the human capital point of view. At this point, the concept of human capital should be clarified. For this study, the OECD (2001) proposal was adopted, which states that human capital comprises knowledge, skills, abilities, and other individual attributes that facilitate the creation of personal, social and economic well-being.

Technological unemployment (the gradual replacement of people with machines during work) results from technological progress and the development of technologies implemented in industry and the service sector, resulting in lower demand for human labour. Automation and robotisation of industry and services reduce the demand for labour. Often, modern technological solutions are associated with long-term savings and increased efficiency in the production process.

This study aimed to identify, analyse, and assess the sentiment regarding the possibility of the workforce losing their jobs and being replaced with robots and regarding ways to prevent technological unemployment.

This paper is organised as follows. Section 2 contains a literature review. Section 3 explains the research design and methodology. Section 4 reports the analysis results from the survey data, and Section 5 summarises the study's conclusions and discusses the policy implications.

LITERATURE REVIEW

Based on data from the Future of Jobs Report 2020 (Ratcheva *et al*., 2020), it is estimated that by 2025 the number of current jobs will decrease by 6.4% (from 15.4% of the workforce to 9.0%), and the number of new jobs will increase from 7.8% to 13.5%. It is estimated that up to 85 million jobs could be replaced by a shift in the division of labour between people and machines. It is worth noting that reducing the demand for certain professions causes a change in demand on the part of the labour market. On the one hand, robotisation leads to the release of labour resources. On the other hand, these processes create the demand for new professions. As early as 2016, researchers Arntz, Gregory and Zierahn estimated that digital technologies and widespread digitisation would make over five million people unemployed (2016).

Technological unemployment is not a new topic among researchers; as early as 1930, John Maynard Keynes (1930) drew attention to the disturbance of the machine-human balance. It can be assumed that due to the global epidemic in 2020 and 2021, the processes of digitisation of enterprises will accelerate significantly in the coming years (Baryshnikova *et al.*, 2021). Researchers emphasise that the global community is entering an era of high technological unemployment, the victims of which will not be helped by the traditional welfare state (Frey and Osborne, 2017). According to forecasts, the most significant reductions will affect the office, administrative staff, and production staff in individual industries (Arntz *et al.*, 2016). Until recently, researchers considered low educated or low-skilled workers the most exposed to the spectre of job loss to robots (Acemoglu and Restrepo, 2018). The topic of office workers' displacement by robots was limited to customer service or administrative support (Anderson and Smith, 2014).

Researchers discuss lifelong learning and the role of the education system in shaping the next generation of 'digital workers'. In this way, people will be prepared for new digital services and manufacturing (Bertani *et al.*, 2021). Scientific studies on the demand of the labour market are conducted from employers' perspectives. Chan and Moehler (2007) indicate that employers must enable employees to develop competencies, while others emphasise the role of the state and government (Kosicki and Kosicka, 2003), as well as academic centres and the entire education system (Monteiro *et al.*, 2020).

Entrepreneurs worldwide have been faced with the need to provide and organise remote work, process, and human capital management in a virtual environment and ensure production and the supply chain (Fenwick et al., 2021). Rapid changes, forced by an external stimulus, disrupted the stability of employment in Poland and led to mass layoffs; according to a report from the statistical office, unemployment in Poland increased from 5.5% in January 2020 to 6.5% in January 2021, though it had decreased annually since 2013 (GUS, 2021). The OECD forecasts that 19.8% of jobs in Poland are exposed to a high risk of automation and 30.6% are exposed to significant risk. These are high percentages compared to other countries – the OECD average is 14.0% of jobs exposed to a high risk of automation and 31.6% exposed to a significant risk of automation (2020). The government in Poland foresees technological changes, has decided to invest in innovation and allocate money for R&D, and announced tax breaks for entrepreneurs investing in robotisation and automation (Ministry of Entrepreneurship and Technology, 2018). All these activities confirm the high awareness of entrepreneurs and representatives of the country about the changes surrounding us, including technological unemployment.

Interestingly, the author found a few articles on the problem of technological unemployment from the perspective of the workforce. A study by Masayuki Morikawa (2017) showed that only 30.0% of employees fear that their work will be replaced by artificial intelligence and robotics in the future. These were mainly young and unemployed employees and office workers. The percentage of university and vocational school graduates afraid of losing their jobs to machines was even lower. Morikawa also defined sectors whose representatives are least afraid of automation. Among these sectors are childcare, medical care, and education.

Another study on technological unemployment in terms of the perceptions of human capital was carried out by Ivanov *et al.* in May-June 2019, i.e., before the outbreak of the global pandemic. The study was conducted in Bulgaria. The researchers studied the relationship between anxiety related to losing a job to artificial intelligence and factors such as age, position, experience, city size, and self-perception (being innovative, professional, having highly developed technological competencies). The researchers confirmed that people who consider themselves professionals are less afraid of losing their jobs to automation technologies, and automation, in general, awakens a fear. Age also influences the perception of automation: younger people are less afraid of losing their jobs to automation

technologies. Interestingly, the study results did not confirm that job level influences support for solutions to automation fears (Ivanov *et al*., 2020).

Due to deficiencies in previous research, the literature review was carried out using the snowball method – it was based on the text by Morikawa (2017). The search for additional sources was continued, referring to the literature from the bibliography or texts quoting Morikawa. Additionally, research articles related to technological unemployment in Poland were searched for to reflect the local conditions. Open access sources were used.

It is worth deepening the knowledge about the awareness and approach of the workforce to technological unemployment because it is mainly human capital that is responsible for the willingness to shape and develop competencies with the support of employers or the government (including the education system). High awareness of government representatives or employers' offers of development opportunities will ultimately not affect the use of opportunities by human capital. A diagnosis of the workforce's approach to technological unemployment will allow for targeted action. Possible scenarios include introducing changes to the education system at all levels, including universities, or selecting appropriate employee development strategies for workplaces.

RESEARCH DESIGN AND METHODOLOGY

In March 2021, the author conducted a study of a group of professionally active adults in Poland with Internet access. It was decided to survey the Internet using a proprietary questionnaire constructed for the study. This research method made it possible to reach the target group and seemed reasonable due to the situation in the country and the need to work from home.

- 158 respondents completed the online questionnaire (CAWI). The survey was conducted to obtain answers to the following research questions:
- What is the level of awareness of technological unemployment on the part of human capital in Poland?
- What feelings does the vision of losing a job in favour of automation arouse in the Polish labour force?
- Are Polish employees trying to increase their competencies, and if so, how?

It should be emphasized that the survey did not cover the unemployed and people who do not use the Internet (digitally excluded). The respondents were selected by the author, which makes it impossible to generalize the results for the entire population. As the study covered people working in Poland, the results in other countries may differ.

The questionnaire consisted of 12-15 questions (depending on the answers provided), and its completion took approximately 5 minutes on average. The questionnaire was prepared and carried out in Polish, and the results were collected and translated into English only for the purposes of this article. Respondents were asked whether they lost their job in 2020, whether they believe machines may replace their work in the future and whether they feel anxious about this. The author asked respondents whether they believe that their skills are sufficient to maintain work until retirement. In addition, the respondents indicated whether they intend to take measures to increase their competencies in the coming year and explained what these activities (studies or courses) would be and what competencies (broken down into technical, cognitive, and social) they intend to develop. The author also asked the respondents about their education, age, employment sector, position, and place of residence (large city, small city, village). The method of analysis was summation and cross-tabulation by individual characteristics. Some values were also statistically tested using the chi-square

test – comparing two groups of qualitative variables on a nominal scale (accepted significance: $p<0.05$).

RESULTS AND DISCUSSION

General results

158 people took part in the study: 114 women and 44 men. 43 respondents are people in managerial positions (27.2%), and 115 respondents are non-managerial (72.8%). As many as 77 (48.7%) respondents occupy administrative and office positions. A significant proportion of the respondents (73.4%) have a higher education.

Almost 70% (precisely 69.6%) of all respondents live in a large city with more than 10,000 inhabitants. The remaining respondents live in small towns with less than 100,000 inhabitants (16.5%) and the countryside (13.9%). 17 people (10.8%) indicated that they had lost their jobs in 2020, contributing to their insecurity in the labour market. As many as 8 people out of 17 indicated that they had lost their jobs due to reducing people working in a given position.

Office workers fear being replaced by a machine (9 out of 17 respondents are fearful). Only less than 30% of respondents (29.1% to be exact) believe that their work can be replaced by machines, which confirms the results obtained by Morikawa (2017), and only 10% of all respondents feel fear because of the possibility of being replaced by a machine. 62.5% of people who fear losing their job believe that their competencies are insufficient to keep a job until retirement. The vast majority of them (87.5%) want to expand these competencies. It might seem that the processes of automation and the feeling of fear of losing a job would affect mainly blue-collar workers. However, only 18.8% of blue-collar workers feel anxious because of this (3 out of 17 respondents feel anxious), and as many as 56.3% of people feel anxious about losing their jobs.

Replacement by machines

29.1% of respondents believe that machines can replace their work, and almost one-third (31.6%) of them feel anxious because of this. Most people who believe that their work may be replaced by machines (58.7%) want to increase their competencies within the following year. They are mainly administrative and office workers (over 63.0%). 10.1% of all respondents fear being replaced by a machine. Over 62.5% believe that their competencies are not enough to keep a job until retirement. Almost all of them want to expand these competencies – they focus on technical, cognitive, and social competencies to an equal extent (insignificant differences).

Position

There turned out to be a significant division among people occupying managerial and non-managerial jobs. 86.1% of managers believe that their work will not be replaced by machines, while 69.8% of managers believe that they have competencies that will allow them to remain in employment until retirement. Despite this, 88.4% of managers intend to develop competencies. Interestingly, only 20.6% focus on digital competencies; others (79.4%) focus on soft competencies – cognitive and social ones. Meanwhile, 65.2% of people employed in non-managerial positions believe that machines will not replace their work. Almost 70% (69.6%) believe that they have competencies that will allow them to remain in employment until retirement. Despite this, 87.0% intend to develop their

digital, social and cognitive competencies (statistically insignificant differences), although digital competencies have a slightly more significant need for development (35.8%). The author decided to check two dependencies – between:

- position and the recognition that machines will replace the respondent's work within the next 20 years
- position and fear of losing a job to a robot

The chi-square test confirmed a statistically significant relationship between the position and fear due to the possibility of losing a job to a robot (Table 1). The relationship between the position and the recognition that in twenty years, the respondent's work will be replaced by machines turned out to be statistically non-existent. Such results go against those of Ivanov *et al.* (2020). However, this discrepancy can be explained by local differences in the country and the time of the study – before and during the global pandemic.

Table 1

Chi-square test – relationship between the position and fear due to the possibility of losing a job to a robot

	Managers	**Non-managers**	**Marginal Row Totals**
Possibility of losing a job to a robot Answer: Yes	6 (12.52)	40 (33.48)	46
Possibility of losing a job to a robot Answer: No	37 (30.48)	75 (81.52)	112
Marginal column totals	43	115	158

The chi-square statistic is 6.5794. The p-value is 0.010316. Significant at $p<0.05$.

Source: Created by the author.

Sector

The respondents indicated belonging to 17 industries. If the number of respondents from the industry analysed did not exceed 5 people, they were grouped into "other" industries.

According to their representatives, industries that machines will replace within the next 20 years are industrial processing and financial activities. Industries that, according to their representatives, will not be replaced by machines in the next 20 years are public administration, national defence, social security (94.1% of respondents from this group); education (84.6% of the representatives of the education sector); information and communication (83.3% of respondents from this group); and professional, scientific, and technical activities (80.0% of respondents in this group). 57.1% of the industrial processing sector representatives believe machines will replace their work within 20 years. 55.6% of the financial sector representatives share this opinion.

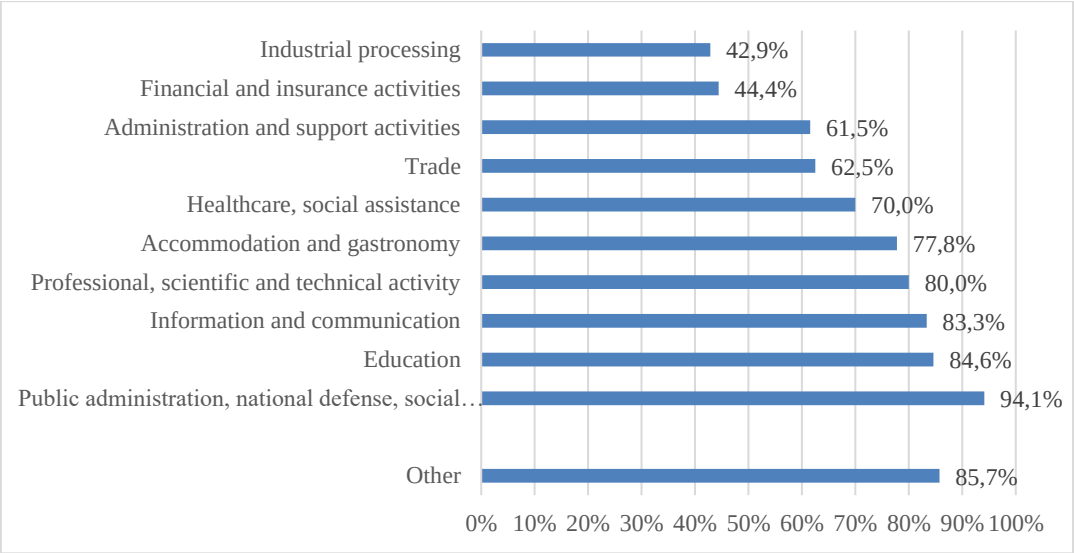

Figure 1 **Percentage of people thinking their work cannot be replaced by machines, broken down by industry**

Source: Created by the author using MS Excel. The results do not add up.

Education

116 out of 158 respondents have a university degree – in Poland, this is understood as a minimum of a bachelor's degree; the rest (42 people) have lower than a university degree. The author decided to check two dependencies – between:

- education and the recognition that machines will replace the respondent's work within the next 20 years
- education and fear of losing a job to a robot

The chi-square test confirmed the lack of correlation between education and the sense of fear due to the possibility of losing a job to a robot and between education and the recognition that machines will replace the respondent's work in twenty years.

Place of residence

110 out of 158 respondents live in large cities with more than 100,000 inhabitants. The remaining 48 people live in small towns or villages. A dependence test between the variables was carried out:

- place of residence and the recognition that machines will replace the respondent's work within the next 20 years
- place of residence and fear of losing a job to a robot

Both chi-square tests performed showed no statistically significant correlation. The relationship between the place of residence and the recognition that machines will replace the respondent's work in the next 20 years is $p=0.710529$. The relationship between residence and the fear of losing a job to a robot is $p=0.710529$.

Fear of losing a job

One statistically significant relationship was determined by the research conducted (managerial or non-managerial position, and the recognition that machines will replace the respondent's work within 20 years). The author decided to carefully analyse responses in which people indicated that they were afraid of losing their jobs.

16 out of 158 respondents fear losing their jobs to robots. 3 out of 16 people lost their jobs in 2020 (18.8%). Almost everyone who feels anxious about losing their jobs to machines (15 out of 16, 93.8%) believes robots will replace their activities within 20 years. 87.5% (14 out of 16 people) want to develop their competencies in the future. Respondents afraid of losing their jobs to machines are primarily young people: 50.0% are 18-25, another 25.0% are 26-30, the rest (12.5% each) are aged 31-40 and 41-50. Administrative and office workers feel the most fear of losing a job (56.3%). The second most fearful group is workers (18.8%).

9 out of 16 anxious respondents (56.8%) come from large cities. An interesting observation is that 50% of people who fear losing their jobs to automation indicate working in the financial and insurance sectors.

Preventing technological unemployment – competency development

Interestingly, almost 70% (69.6%) of the respondents believe that their current competencies are sufficient to keep a job until retirement, yet the vast majority (87.3%) want to develop these competencies. One visible trend is the desire to increase competencies online or by self-training instead of learning during studies. Less than 30.0% of respondents plan to study for at least two semesters within the following year. People are more willing to increase their competencies on their own or during online or in-person courses and training (Figure 2).

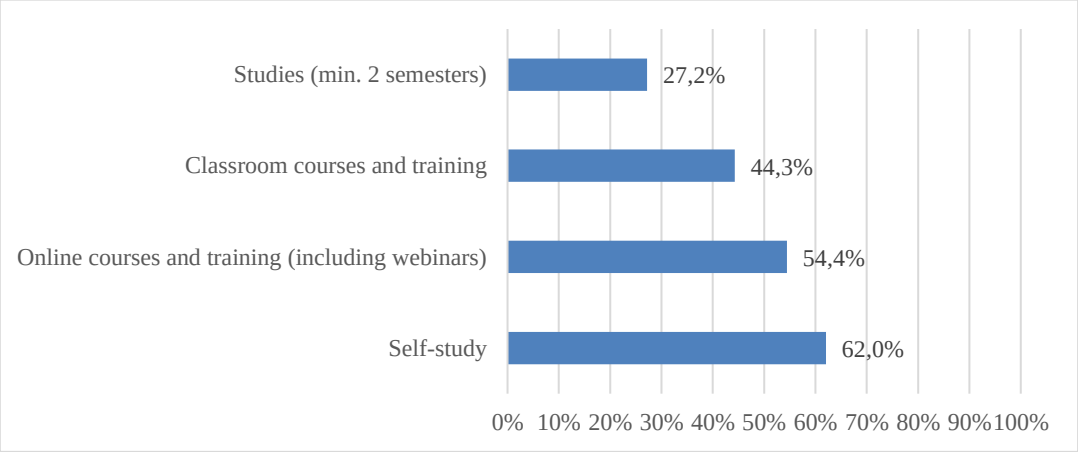

Figure 2. **Respondents' ways of developing their competencies**

Source: Created by the author using MS Excel. Multiple choice question. The results do not add up.

Among people who believe that their competencies are insufficient to keep a job until retirement, almost half (47.9%) are employed in administrative and office positions.

People in managerial positions indicate instead developing social and cognitive competencies (79.4% of managers), while those in non-managerial positions want to develop all competencies to an equal degree. The respondents could choose more than one answer to this question. Therefore, it was considered justified to carry out further statistical analyses. The willingness to develop technical and non-technical skills (social and cognitive skills together) among managers and non-managers was compared. The chi-square test showed a statistically significant difference, p = 0.026597 (Table 2).

Table 2

Chi-square test – relationship between the position and willingness to develop social and cognitive or technical competencies

	Managers	**Non-managers**	**Marginal Row Totals**
Want to develop social and cognitive competencies	50 (42.97)	113 (120.03)	163
Want to develop technical competencies	13 (20.03)	63 (55.97)	76
Marginal column totals	63	176	239

The chi-square statistic is 4.9168. The p-value is 0.026597. Significant at p<0.05.

Source: Created by the author. Multiple choice question.

CONCLUSIONS

The article aimed to identify, analyse, and assess the mood regarding the possibility of employees losing their jobs and being replaced by robots and regarding methods of preventing technological unemployment. The conclusions from the research answer the research questions posed in the section 'Research design and methodology'.

What is the level of awareness of technological unemployment on the part of human capital in Poland?

1. The results obtained and the analysis of secondary sources confirm that the workforce is not afraid of technological unemployment. However, people want to increase their competencies despite the lack of fear. The problem of technological unemployment exists, and despite the lack of fear, it may affect individual sectors of the economy. The lack of awareness among human capital is a serious problem because it can contribute to the economic slowdown of the country and the real threat of an increase in unemployment and the need for social support.

What feelings does the vision of losing a job in favour of automation arouse in the Polish labour force?

2. It has been observed that there is a fear of a future replacement by robots among digitally born young workers. This trend confirms the results obtained by Morikawa (Morikawa, 2017). Young employees know how quickly modern technologies bring about a revolution in various sectors. Employees of the financial and insurance sector feel particularly at risk, which is confirmed by the dynamic development of the FinTech sector in Poland (Halasik-Kozajda

and Olbrys, 2020). The fear of being replaced by robots applied mainly to office workers. After them, blue-collar workers indicated the most fear.

Are Polish employees trying to increase their competencies, and if so, how?

3. One significant factor turned out to be the relationship between the position (managerial and non-managerial) and the possibility of being replaced by machines. Managers believe that machines will not replace them in the next 20 years. It is worth deepening research related to the role of a manager in the modern world and the competencies and skills that he must have to fulfil his role.
4. Another exciting observation seems to be the desire to develop social and cognitive competencies on the part of managers, with reduced interest in developing technical competencies. Perhaps managers realise that technical competence is not as valuable for their daily work, as robots will handle this in the future. The author intends to conduct further research focused on improving social competencies among managerial staff.

RECOMMENDATIONS

1. Lack of awareness suggests a lack of education. The state's role is to build awareness and willingness to learn and allocate funds according to demand. It would be advisable to conduct further research in the field of awareness of technological unemployment among researchers, particularly on a representative sample, which would allow for the observation of trends in the long-term perspective and taking appropriate measures.
2. Building a welfare state may turn out to be insufficient (Frey and Osborne, 2017) – only a long-term perspective on changes in the organisation of the market and labour on the robot-human line will bring satisfactory results. Therefore, the Polish state should implement changes in the education system from an early age to build lifelong learning and cooperation with robots. The state should also allocate funds to developing industries so that unemployment does not increase over the following decades, and thus the expenditure on benefits does not increase.
3. Graduates will need several competencies to function in the surrounding, rapidly changing world. In addition, Polish universities should independently monitor national and global trends and open only future-oriented fields of study. Universities should also monitor the demand for studies (which has turned out to be minor) and enrich their offering with in-person and online training.

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