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Jobs not Threatened by Automation in the Future in the Slovak Republic

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Abstract

Industry 4.0 brings with it an increase in new forms and methods of work based on automation and digitization, which gradually threaten jobs in individual countries. Most studies published on this topic describe the expected proportion of jobs that are threatened with extinction. The aim of the presented study is to investigate the opportunities that the introduction of Industry 4.0 brings with it.

The presented study calculates the share of jobs with a low risk of being threatened by automation in the Slovak Republic. This is a unique approach to researching the impact of innovation trends on the labor market, which identifies jobs that are difficult to replace by machines. The calculation of the share of jobs with a low risk of being threatened by automation is based on the connection of two data sources – National system of occupations (a description of the skills required for every job in the Slovak Republic) and Information system on the price of work (modern and effective national labour cost statistical survey focus on wage earnings, including the calculation of the number of employees in individual job positions).

Of the total number of 2 million working people in the Slovak Republic, 24% will not be threatened by automation. These are jobs that require at least one of the following skills for their performance: creativity, organizing and planning work, the ability to make decisions and take responsibility, leadership skills, critical thinking and talent. Several authors investigating the issue of innovations and their effects on jobs define the above-mentioned skills as difficult to be replaced by machines.

The findings presented in the paper create space for further discussion at the national level about which skills and competences will need to be supported in lifelong learning among employees in order to prevent the high rate of replacement of jobs by automation, which the OECD predicts for the Slovak Republic.

Keywords: classification of occupations, competences, economic productivity, job automation, digital skills, Industry 4.0, labor market,

JEL Classification: E24, F62, J01, J24

1. Introduction

The labor market, which is long-term influenced on a national and international scale by processes that change its character and which affect its most important component – human resource. Industry 4.0, which can be loosely defined as the introduction of technological and innovative trends into production processes, is a focal topic that has a significant impact on employment, the creation and structure of jobs. In this context, the expected automation of more than 60% of jobs in the Slovak Republic is considered a significant problem. Several authors in the Slovak Republic deal with the question of the level of employment threats, on the other hand, the identification of non-threatened jobs and the quantification of the number of employees in these positions are considered to be a less

researched area. The goal of the contribution is therefore to identify the share of jobs with a low risk of automation threat in the Slovak Republic due to the influence of Industry 4.0. The basis of the research are skills that have been identified by prominent foreign authors as difficult to replace by machines (technologies). It is a set of skills that are typical for a person, such as talent, creativity and others. For these skills, through the national system of occupations in the Slovak Republic, specific jobs were identified, in the performance of which employees are required to have at least one of the skills that are difficult to replace with machines. By identifying these jobs, linking them to the national job classification SK ISCO-08 and subsequently analyzing data from the statistical survey Information System on the Price of Labor (ISCP), the authors of the article came to the following findings: approximately 24% of jobs in Slovakia will be at low risk of automation. Primarily, these are employees with a university education and a job that falls within the first three main classes within the SK ISCO-08 classification (Legislators and management staff, Specialists and Technicians and professional staff).

Early studies linked Industry 4.0 to worker substitution and rising unemployment (Bowles, J., 2015). Some researchers say that the extent to which Industry 4.0 will reduce employment is often overestimated (Bonin, H., Gregory, T. & Zierahn, U., 2015.) Graetz a Michaels (2015) they also argue that the use of robots in industries reduces the share of low-skilled employment rather than total employment. The authors report that this increase in automation technology has not led to job losses overall – in fact, it's probably the opposite. By linking patents to industries and industries to locations, they aim to measure the statistical effect of automation patents on local employment. They found that over a five-year period, automation patents generally led to an increase in overall employment expressed as a percentage of the population (Smith, N., 2018).

Researches have also confirmed the fact of several studies that qualified jobs will not suffer from the introduction of automation. Business process redesign involves more than just implementing artificial intelligence; it also requires a significant commitment to developing employees with what is called „skills that are associated with fusion“ – those that allow them to work effectively at the human-machine interface (Wilson et al., 2018). It is in the best interests of organizations to support the motivation and well-being of their employees during organizational change. One example is the robotization of work in such a way that even employees perceive the result as valuable. This is particularly important when supporting and expanding human competencies and benefits in service jobs with next-generation robots. The study according to Turja T. et al. (2022) investigated the realization of material and psychological needs related to work between robotized and non-robotized workplaces, as well as the relationships between robotization, basic needs and job satisfaction (Turja, T. et al., 2022). Firms should therefore consider developing a training strategy and investing in training efforts to support the development of additional competencies (Rad, Fakheddin, F. - et al., 2022).

2. Literaturw Review and Hypotheses

The theoretical starting points of the examined issue were summarized as follows in individual paragraphs. The results of the research of several authors devoted to the topic of automation and replacement of labor forces, bring findings that are the basis of the research in this paper. The automation and replacement of labor forces by technology alone does not have to mean the disappearance of jobs. The historical investigation of previous innovation trends showed that in several cases, the workload of employees was changed by new tasks and competences that they did not know or were not aware of before. Benzel et al. (2015) debated whether it exists „substitution effect“ robots to work by creating an intertemporal iteration model (OLG). Model derivation shows that under certain conditions, robots can completely replace low-skilled jobs and partially replace high-skilled ones, which will lead to a decrease in labor demand and a decrease in wages.

Many studies devoted to the share of automatable positions in the countries of the Organization for Economic Cooperation and Development (OECD) evaluate the countries of Eastern and Southern Europe as significantly threatened by the automation of jobs (Nedelkoska et al., 2018). On the other hand, it can help create new jobs through key competencies. According to Manyika a Sneadera (2018) automation could displace about 15 percent of the world's workforce, or about 400 million workers, between 2016 and 2030. Most of the debates and studies have focused on the fact that many jobs in industry will be replaced by machines, and that automation will also create new jobs. According to Cedefop's European Skills and Employment Survey, it is „around 14% of jobs in the EU at risk of being replaced by computer algorithms. The jobs that will be most affected are those that depend more on routine tasks and that require few cross-functional and interpersonal skills“ (CEDEFOP, n. d.). Upon closer examination according to (Dahlin, E., 2019) automation, including robotics and artificial intelligence, is expected to spread unevenly in the labor market, so middle-skill occupations that do not require a college degree are more likely to be negatively affected because they are easier to automate than high-skill occupations. One of the focal socio-economic influences on the labor market is the influence of Industry 4.0. New technologies and their introduction into practice bring with them the fear of replacement of work by machines. These concerns are

supported by many studies, which perceive the Slovak Republic as one of the most threatened countries in terms of replacement of labor force by automation. These studies point to the fact that the structure of our domestic labor market consists in many cases of jobs for which routine mastery of selected skills is sufficient. It is those that are described as easily replaceable by new technologies. One of the important studies by Frey and Osborne (2013) estimates the degree of automation for the US labor market. At the same time, they use 702 jobs, which, in cooperation with experts, determine the potential of automation. Their results are subsequently taken over by other authors and applied to European countries as well.

According to the report of the European Commission that „it requires significant investment in adapting to the new demands of the labor market, which require new and more advanced types of skills and qualifications. Only 33% of Slovaks currently have digital skills higher than basic“ (Európska Komisia, 2019a, s. 38). At a more general level, a review of the policy literature identified a dominant narrative that sees contemporary digital innovation primarily as the root cause of challenges to the labor market, with the primary responsibility for being able to operate successfully in this market being placed on individuals in the form of „increasing skills“ (Schlogl L. et al., 2021).

Although the reduction in prices caused by the increase in productivity after the use of robots can improve the welfare of workers to some extent, it cannot fully compensate for the damage caused by „substitution effect“ to workforce. As a result, the researchers suggest that the use of robots could lead to so-called Immersive growth – economic growth but a decline in social well-being (Benzel a kol., 2015). Empirical analysis by Abelian and Prettner (2017) argues that countries with lower population growth rates will take the lead in adopting and inventing new automation technologies to overcome the negative economic impact of declining population growth. Research by Sachs and Kotlikoff (2012) and Guo Kaiming (2019) shows that artificial intelligence technology will asymmetrically change the productivity of various production factors in the process of combining with machines and equipment. For many organizations, the biggest reason for not replacing manual work with robots is purely economic (Zinser, M., Sirkin, H., & Rose, J. R., 2015).

According to Badet J. (2021) and some reports, automation through new competencies will create more jobs than it will displace them. Therefore, the main novelty is that, in addition to the part of jobs that are displaced by automation, it also leads to the creation of new, more complex versions of existing tasks, which leads to a demand for employment and for new competencies. According to Kamasak R. (2015), the impact of technological capabilities on innovation performance was greater than any other factors that occurred in his research. According to Han, Y. (2022), the prospects are bright, but risks and opportunities coexist at the same time, and disputes and doubts always exist. Statistics from the database: World Inequality Database (WID) show that in several countries with significant robot applications, the income share of the top 10% is increasing year-on-year, and the more pronounced the increase in robot use, the more pronounced the phenomenon. Technological progress bias has been much debated in recent years, with some scholars attributing the increase in inequality in the economy to technological progress. In the context of innovation, many new companies fail due to inherent risks, and critical thinking, among others, is considered essential in business education. As such, applying critical thinking to risk reduction initiatives and considering different courses of action is vital to successful innovation (Rampersad, G., 2020).

The starting point of our investigation is the polemic of the authors Arntz et al. (2016) to the results of Frey and Osborne (2013). Their main approach to examining the impact of innovation is not based on the assessment of occupations as a whole, but focuses on the tasks that are required to perform specific occupations. According to the authors, applying a task-based approach to a specific job leads to a much lower risk of automation compared to an approach based on automating the entire occupation.

The presented article has established 3 following hypotheses:

1. A quarter of employees in the Slovak Republic need skills with a low risk of being threatened by automation in the coming period to perform their jobs“.

2. "Jobs with a low risk of being threatened by automation are in most cases skilled positions with a need for higher education".

3. Qualified jobs will not suffer from the introduction of automation

From the findings of the authors were summarized the information that speaks mainly about specific tasks, competences and skills that will not be threatened by automation today and even in the next few years. These are an important basis for being able to identify jobs that will not be automated in the coming period, or replaced by

machines in full range. In table no. 1, these findings are summarized according to the authors, respectively of the mentioned studies.

Table 1. Summarization of the most important findings of foreign approaches in the field of replacement of employees with technologies

TITLE OF THE STUDY	FINDINGS
David H. Autor (2015)	Automation does not have to reduce overall employment, it can only result in a reduction in labor requirements and **creation of space for new competencies and tasks of employees.**
	Polanyi's paradox - there are activities that require specific skills, such as **sensorimotorics, critical thinking, judgment, intuition, creativity, spoken word and others. These features cannot be programmed by programmers and therefore cannot be automated.**
Frey a Osborne (2013)	Based on available literature and Oxford University research, the authors identified three categories of tasks **that cannot be replaced by technology**. These are tasks that require: - **creative intelligence** (according to the authors, creative intelligence can include any psychological process that is the basis of human creativity, e.g. creativity), - **social intelligence,** - **perception and manipulation.**
	Robots cannot recognize human emotions in real time.
Arntz and team (2016)	**Physically demanding, repetitive, dangerous and monotonous work declined in the monitored decades (1980-2010).**
	The authors replaced the approach based on the evaluation of occupations as a whole with an approach **focused on tasks that are necessary for the performance of occupations** (international assessment of key competences PIAAC). According to the authors, applying a task-based approach leads to a much lower risk of automation compared to an occupation-based approach. The PIAAC data is a unique data source that contains micro-level indicators of socio-economic characteristics, skills, work-related information, work tasks and competencies. While Frey and Osborne found that 47% of jobs are automatable, research by Arntz et al. (2016) produced a result at the level of 9% for the same country.
	A significant controversy of Frey and Osborne's (2013) approach is that their results are taken up by other authors and implemented in other countries, while **the competencies for the performance of these professions and the summary of tasks may differ significantly between countries.**
	Not entire jobs are exposed to automation, but only specific work tasks.
World Economic Forum – The Future of Jobs report 2020	**Tasks that cannot be replaced by machines** and can only be performed by humans are **decision-making, consulting, communication, reasoning or management.**
	Skills that employers predict **will grow the most through 2025**: **critical thinking and analysis, ability to solve problems, ability to properly organize work and time, work with people.**
Deloitte - Employee readiness for the digital revolution	**Low-skilled employees may be at risk** – the research found that employees with lower education are more skeptical of technology, in contrast to employees with higher education, who consider new technologies as an opportunity to acquire new skills.

Source: author's processing

3. Methodology

The analysis method allowed us to examine the impact of Industry 4.0 and technological changes on the labor market. Through the method of theoretical analysis, we aimed to summarize the socio-economic trends affecting

the national economy of the Slovak Republic from various relevant sources. Using the method of theoretical analysis, we searched for and identified the previous approaches of several authors regarding the impact of Industry 4.0 on the automation of jobs. The level of their threat is interpreted at different levels depending on the approach the given author applied.

We used the logical-historical method for summarizing and processing relevant foreign studies, for investigating the impact of innovative technologies on human resources in the past decades, while the starting point for our investigation was the results of the work of Arntz et al. (2016). The authors recommend investigating the level of job threats due to automation by evaluating individual work tasks of employees that have different degrees of automation. We applied their finding in the conditions of the Slovak Republic and examined individual jobs from the point of view of whether the employee needs to use a skill for their performance, which is at a low risk of being threatened by automation in the coming period. The set of such jobs provided an insight into what proportion of jobs will not be threatened in the coming years due to the introduction of innovative technologies.

The key question is whether artificial intelligence represents a technological breakthrough that will change the world of work suddenly and without warning, with major implications for employment, or whether it is just another step in digital transformations that have been underway for several decades (Benhamou , S. et al., 2018). However, most publications have discussed expected theoretical assumptions, while empirical evidence of actual changes is scarce (Hirsch-Kreinsen, H., 2016).

Calculation of the share of jobs with a low risk of being threatened by automation in the total employment of the Slovak Republic: when examining the theoretical starting points, we use the method of induction based on the results of the research of several authors, representatives of relevant institutions and discretion based on practical experience identified a set of seven key competencies, which appear to be difficult to automate, or replaceable by machines in the coming period:

- Organizing and planning work;
- Ability to make decisions and take responsibility;
- Talent;
- Creativity;
- Critical thinking;
- Strategic and conceptual thinking;
- Leadership skills.

In the form of an analysis, we decided to find out the share of jobs in the Slovak Republic where employees need the above-mentioned competencies at the highest level (marked as “high level“). The only relevant and most extensive source of data in this area in the Slovak Republic is the National System of Occupations, which is defined by Act No. 5/2004 Z. z. collections of laws on employment services in their current version as a „comprehensive information system describing standard labor market requirements for individual jobs.“ Based on one of the many goals of the National Project Sector-driven innovations to an efficient labor market „monitoring of developments in sectors with an emphasis on changes in the required skills, knowledge and competences of workers in specific jobs“ we worked with the competency model database for all guaranteed national occupational standards (Note 1)(NOS). This unique set of data provides a wide range of information describing the requirements of employers for individual jobs.

We consider it the most important information for every NOS:

- Recommended level of education;
- Slovak qualification framework (SKKR);
- Regulations;
- Certificates and other written certificates;
- Professional practice;
- Statistical classification of professions SK ISCO-08 (classification SK ISCO-08);
- European classification of skills/competences, qualifications and occupations ESCO;
- Statistical classification of economic activities SK NACE Rev. 2;
- Competences:
    - general key competencies,
    - specific key competencies,
    - professional knowledge,
    - professional skills.

Specific key competencies „they form competences and dispositions/aptitudes that are necessary only for certain jobs, at one of three levels (elementary, advanced and high).“ The information system of the National Project on Sector-Driven Innovations for an Effective Labor Market, in which more than 900 experts from the Slovak Republic work, includes the possibility to choose from a total of 11 items when creating the NOS, among which are the seven key competencies mentioned above, which we used for the purpose of our research they chose. During the evaluation, we worked with the following range of selected jobs:

Table 2. Number of NOSs in which one of the listed high-level competencies is required

Selected specific key competence	Summary (NOS)
Ability to make decisions and take responsibility	669
Organizing and planning work	503
Strategic and conceptual thinking	486
Creativity	266
Leadership	231
Critical thinking	149
Talent	63

Source: Information system of the National Project Sector-driven Innovations for an Efficient Labor Market, author's processing

Exported data on NOS, whose competence model contains at least one of the seven specific key competencies examined, were supplemented with data on the SK ISCO-08 employment classification, which is assigned to each NOS. This achieved a link between the NOS, where experts from the sector councils identified a high need for competence with a low risk of threat from automation, which is not easily replaced by machines, and at the same time a link to an important job classification, which offers a large number of possibilities for further investigation.

3.1 Connection with the National Classification of Occupations SK ISCO-08

Classification SK ISCO-08 is the national classification of occupations, which is issued by the Decree of the Statistical Office of the Slovak Republic no. 449/2020 Collections of Acts as amended. „By linking the NOS with the SK ISCO-08 classification, each job can be supplemented with a qualitative side consisting of standard labor market demands and a quantitative side consisting of determining the employment and structure of workers performing the work tasks of the given job in arbitrary divisions“ (Trexima Bratislava, 2019b, p. 303). Each of the investigated NOS contains the SK ISCO-08 classification determined by experts. On the basis of the connection of NOS (only those that need a competence/skill to perform the job with a low risk of being threatened by automation) and at the same time the SK ISCO-08 classification as a unique identifier for each occupation, it was possible to analyze these occupations in terms of their frequency. For this purpose, we used data from a statistical survey on the price of work (ISCP). This survey, which “systematically secures and evaluates data on employee compensation broken down by occupation, gender, education, age, qualification and other characteristics“ (Trexima Bratislava, 2017, p. 2). It is one of the most extensive statistical surveys carried out in the Slovak Republic, as evidenced by the following data on the collected intelligence units and employees for the monitored period 3Q 2021:

- 9 154 intelligence units in Slovak Republic,
- 1 084 962 processed employees in Slovak Republic.

Using this data, we were able to identify the number of employees (and subsequently their share of total employment in the Slovak Republic), who potentially should not be threatened by automation and replacement by machines so significantly. In addition, we assessed these occupations from the point of view of the educational structure of the employees who work in the given positions in the Slovak Republic, and we also tried to evaluate the representation of these occupations from the point of view of the main classes of the SK ISCO-08 classification. With these findings, it was possible to identify what proportion of occupations in the Slovak Republic will not be significantly threatened by automation, what kind of education the employees working in these occupations have and in which main classes of the SK ISCO-08 classification they work.

4. Discussion and Results

The results of the research of several authors, dedicated to the topic of automation and labor replacement, brought findings that became the basis of our further research. The automation and replacement of labor forces by technology alone does not have to mean the disappearance of jobs. From the findings, we summarized the

information that speaks mainly about specific tasks, competences and skills that will not be threatened by automation today and even in the next few years. These are an important basis for us to be able to determine jobs that may not be automated in the coming period, or replaced by machines in full range.

Although human capital is potentially applicable to all jobs, tasks, occupations and industries, the demand for human capital is not uniform across domains – that is, some activities are more skill-intensive than others (Acemoglu, D. et al. 2011).

As part of the database of the National Project Sector-driven Innovations for an Efficient Labor Market, all NOSs where at least one of the seven monitored competencies at the highest level appeared in the competence model were exported (level high). Subsequently, the classification codes of employees from the SK ISCO-08 classification at the lowest level were attached to these NOS. The database created in this way was used for further work in evaluating their risk of being threatened by automation. Based on the assignment of the SK ISCO-08 classification code, it was possible to analyze these jobs from the point of view of the number of employees in the Slovak Republic and the educational structure.

The theory of human capital has become the basis of educational policy in many developed countries in recent decades. However, scholarly debate often underestimates the research findings and developments related to this theory that, since the 1970s, have steadily enriched the understanding of how human capital contributes to personal well-being and the socio-economic development of society as a whole. (Kuzminov Ya., Sorokin P., Froumin I., 2019).

Based on the above findings, we developed a list of seven specific key competencies that are considered difficult to replace by machines in the studies mentioned. This is a set of competencies already mentioned above and subsequently divided into Table No. 2.

The determination of these competencies as well as their selection was based on the mentioned foreign research and at the same time these competencies had to be chosen in such a way that they were compatible with the available data in the Slovak Republic. For this purpose, the competences based on these researches were connected with the National System of Occupations, which is defined by Act no. 5/2004 Collections of laws on employment services as amended „comprehensive information system describing the standard requirements of the labor market for individual jobs. The national system of occupations determines the requirements for professional knowledge, skills and abilities necessary to perform work activities in jobs on the labor market.“ Its center is the Employment Register made up of the NOS, which describe employers' requirements for qualified employment performance. The employment register consists of 1 915 NOS, which, among other things, contain a part " specific key competencies“. By means of this information, it is possible to select only those NOS, which in the competence model contain at least one of the aforementioned competences, which, according to foreign research, will be at a low risk of being threatened by automation in the near future. In addition, each NOS contains a section „classification“, within which information is given on the assignment of NOS to:

- classification SK ISCO-08,
- statistical classification of economic activities SK NACE Rev. 2,
- European classification of skills, competences and occupations ESCO.

The assignment of NOS to a specific 7-digit code of the SK ISCO-08 classification brings the possibility of a detailed examination of jobs at the national level in terms of the competencies that are necessary for the performance of jobs. It is a unique way of examining the impact of automation and technological innovation on jobs, directly following the findings of Arntz et al. (2016). They recommend analyzing individual competencies directly within national jobs and their work tasks.

As part of the database of the National Project on Sector-driven Innovations for an Efficient Labor Market, all NOS were exported, in which at least one of the seven monitored competencies appeared at the highest level within the competence model (high level). Subsequently, the classification codes of employees from the SK ISCO-08 classification at the lowest level were attached to these NOS. The database created in this way was used for further work in evaluating their risk of being threatened by automation. Based on the assignment of the SK ISCO-08 classification code, it was possible to analyze these jobs from the point of view of the frequency of employees in the Slovak Republic and the educational structure.

The total share of employees with at least one of the seven examined competencies at a high required level is approximately 24%. Following the findings of various authors, it can be concluded that **these employees will not, from the point of view of automation, or technological replacements are significantly threatened, as their work requires a high level of competences that cannot be replaced by machines today and not even in the near future.** It is possible to assume that in the performance of their work, innovations, technologies and

automation of certain processes will be a complementary element that will help to increase the efficiency and quality of the work performed. At the same time, there may be a situation where there will be a high increase in unemployment and the number of unemployed who can and will be willing to work, but there are no suitable job opportunities for them.

Table 3. Share of employees in the total number of employees in the Slovak Republic who use selected specific key competencies at a high level at work

The name of the specific key competence	**The share of employees using a specific competence in the total number of employees in the Slovak Republic (3Q 2021) (**Note 2)
Ability to make decisions and take responsibility	11,93 %
Organizing and planning work	11,52 %
Leadership	8,93 %
Strategic and conceptual thinking	8,37 %
Creativity	4,55 %
Critical thinking	2,98 %
Talent	0,51 %

Source: National project Sector-driven innovations to an efficient labor market, author's processing

Following the findings of several authors, it can also be stated in the conditions of the Slovak Republic that employees with at least one high competence will not, from the point of view of automation, or technological replacements are significantly threatened, as their work requires a high level of competences that cannot be replaced by machines today and not even in the near future. It follows that this mentioned group of employees - part of the employees - is not primarily at risk in the coming period due to automation.

The first hypothesis was confirmed. The definition of the hypothesis is as follows:

"A quarter of employees in the Slovak Republic need skills with a low risk of being threatened by automation in the coming period to perform their jobs".

This investigation brings a different perspective on the impact of innovation trends. While most studies and analyzes deal with the expected proportion of jobs at risk, in our study jobs with a low risk of being threatened by automation were evaluated.

On the basis of linking the data with the statistical survey on the price of labor (ISCP), it was possible to evaluate low-risk jobs in terms of the level of education. We are based on the findings of several authors listed in table number 1, who consider educated employees to be less at risk. This statement became a prerequisite for us to establish the second hypothesis:

"Jobs with a low risk of being threatened by automation are in most cases skilled positions with a need for higher education".

This assumption was also verified with a positive finding. A significant majority of employees who need at least one of the selected competencies with a low risk of being threatened by automation to perform their jobs have a university degree.

This also fulfilled the assumption that innovative trends will not be a threat to those employees who have higher qualifications. In addition, another fact related to endangered jobs was confirmed within the framework of the examination of hard-to-replace competencies. The jobs in which we identified the need to use competence with a low risk of being threatened by automation were also evaluated in terms of their representation in the main classes of the SK ISCO-08 classification. This confirms the experts' expectation that qualified jobs, represented mainly in management and specialized classes, will be threatened with a very low rate in the coming years.

A large part of the jobs we examined, which we evaluated as jobs with a low risk of being threatened by automation, represent the main classes 1- Legislators, management staff, 2 - Specialists and 3 – Technicians and professional workers. The research also confirmed the fact of domestic and foreign studies that qualified jobs will not suffer from the introduction of automation.

Competence „The ability to make decisions and bear responsibility“: Of all employees who, according to the NSP, need competence to perform their work „Ability to make decisions and take responsibility“ up to 60% have

university education. Employees with a need for this competence work mainly as legislators and managers; Specialists; Technicians and professional workers. This follows from the analysis of data from the statistical survey on the price of labor (ISCP) for the period 3Q 2021.

Competence „Organizing and planning work“: In this case too, we can observe a significant dominance of university-educated employees, who need the competence of „organizing and planning work“ at a high level to perform their jobs. Their share in the total number of employees in the Slovak Republic who need this competence is 60%. An example of jobs with a high proportion of employees, in which there is a requirement for a high level of examined competence: Chief Accountant; Project specialist (project manager); Manager (managing worker) in the field of trade (Sales Director); Executive Director; Site manager.

Competence „Leadership“: Competence is required at a high level for employees, who in most cases have university degrees. Leadership skills are used to the greatest extent in the positions in which 74% of the observed group of employees work. Almost two-thirds of all employees requiring leadership skills work at a high level in positions classified in the main class 1 (Legislators, managers) and 2 (Specialists).

Competence „Strategic and conceptual thinking“: More than 8% of all employees in the Slovak Republic are employees who need high-level strategic and conceptual thinking at work. Almost 70% of them have university education. The majority of employees who need strategic and conceptual thinking to perform their jobs work in positions classified in main class 2 – Specialists.

Competence „Creativity“: More than two-thirds of employees who need Creativity to perform their jobs, has a university degree. More than a third of all employees who need Creativity at a high level in the performance of their work work in jobs classified in main class 2 – Specialists.

Competence „Critical thinking“: Critical thinking at a high level is needed for the performance of work, especially employees with university education. Compared to all employees using the relevant competence, they represent the dominant part at the level of 74%. Almost all employees working in jobs that require Critical Thinking are included in the first three main classes of the SK ISCO-08 classification (Legislators, managers; Specialists; Technicians and professional workers).

Competence „Talent“: Employees with secondary education make up a third of all employees in the Slovak Republic who need Talent to perform their jobs. A high proportion of employees in this group has a university degree – specifically at the level of 57%. More than half of the employees who need Talent to perform their jobs work in main class 2 jobs – Specialists. A fifth of the employees from this group work within the main class 1– Legislators, managers. A sample of jobs with a high proportion of employees, within which there is a requirement for a high level of „Critical Thinking“: Elementary school teacher; Conservatory teacher; Orchestra member; An actor; Director's theater advisor; Cameraman.

5. Conclusion

The main purpose of the research was to identify the proportion of employees with a low risk of being threatened by automation in the Slovak RepublicThe main purpose of the research was to identify the proportion of employees with a low risk of being threatened by automation in the Slovak Republic. Based on these findings and our practical experience with the issue, we have drawn up a list of seven specific competences for which we cannot expect to be replaced by machines in the next few years. For this purpose, it is necessary to identify a set of key skills/competences that cannot be replaced by machines (innovations) today or in the near future. These are competencies that require human qualities that are unique to us, such as creativity, creativity, talent and others. By means of the National System of Occupations, the aim of which is to summarize the requirements of employers for the performance of individual jobs, it is possible to determine such jobs in Slovak conditions that require these hard-to-replace competencies/skills for their performance. In order to be able to determine the share of jobs with a low risk of being threatened by automation, they were linked to the statistical survey of the Labor Price Information System, which provides information on the structure of employees, their number, regional breakdown, breakdown by education, etc. Through this connection, the share of 24% of jobs in the Slovak Republic that should not be threatened by automation in the near future was calculated.

Industry 4.0 brings significant changes to the labor market with a direct impact on human resources. It is necessary to be prepared for these changes and to be able to predict them as widely as possible. The interesting findings of this paper about jobs with a low risk of being threatened by automation brought an insight into which competencies will be key for the preservation of human labor in individual jobs. These are competences that neither today nor in the near future can be fully replaced by technologies. The set of seven identified competencies is an opportunity for the formal education system. The content of teaching and study fields, as well as study programs at universities,

should clearly aim at the development of identified competencies in future graduates. Mastering these competencies offers graduates a wider application in practice and at the same time, following the results of our research, assigns employees to jobs with a low risk of being threatened by automation. It is therefore necessary to develop these competencies in pupils/students.

Within the formal education system, efforts must be made to educate adults who are active in the labor market today. Based on the Strategy of lifelong learning and counseling for the years 2021-2030, developed by the State Institute of Vocational Education (2021), it is necessary to emphasize the education of adults - we are in a time when rapid changes in the labor market force us to change and adapt our professional knowledge and skills. It is therefore essential that the ability to learn and be able to be flexible in the labor market is considered one of the most essential competencies. The current workforce cannot avoid the introduction of new technologies. By investing in education, it can significantly secure a competitive advantage in the replacement of labor forces.

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Notes

Note 1. The national occupational standard defines the requirements for professional skills and practical experience necessary to perform work activities in occupations on the labor market in the relevant sector.

Note 2. Individual jobs can occur more than once for the seven monitored skills/competencies. The share of employees declares only the relevant percentage of employees using the skill/competence in question.