



Current Challenges Affecting the Development of Human Resources in Slovakia

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Abstract: *The paper defines the key factors influencing human resources in the current economic development in Slovakia and points to possible ways of adapting human capital to the rapidly changing world. The paper aims to characterize the expected features of the foreseen digital and knowledge transformation of the Slovak economy and society and to identify possible paths of human resource development, based on the definition of the knowledge economy and the learning society.*

1. INTRODUCTION

Digital transformation consists of several waves through which new disruptive technologies are fundamentally changing and will continue to change the ways businesses operate and the associated economic impact of these changes. New technologies can improve several internal and external business processes, especially relationships with customers, employees, and suppliers. Digital transformation should bring added value for the entrepreneur.

Investments in human capital are essential to ensure that people are part of the solutions being adopted. The human aspect is essential for success in digital transformation. Enterprises that use more specific digital technologies are likely to achieve higher average labour productivity and total sales, and create a higher average number of jobs, compared to those that do not use them.

Digital transformation affects the development of human capital and human resources. Human capital represents all the skills, knowledge, abilities, and experiences that enable an individual to occupy a position at a certain level within a society or community. Human capital is the main resource of profit and value creation in successful and high-performing organizations. It is a fundamental aspect of human resources management procedures.

2. HUMAN CAPITAL IN THE KNOWLEDGE AND DIGITAL ECONOMY – BASIC FRAMEWORKS

As stated by Dudová (2022), in relation to the knowledge economy, we assume that the basic source of wealth creation lies in knowledge and competences. The transition to a knowledge-based economy indicates the development of an economy in which knowledge is an important factor in economic growth, while the evolution of the organization of agents in the

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dynamics of knowledge creation acquires great importance, even regarding the increase of the quantity of knowledge. Investments contained in knowledge make it possible to increase classic factors of production, such as labour, capital, raw materials, and energy. Competitiveness depends on the accumulation of knowledge and its quick and effective mobilization in the process of production of goods and services.

The emergence and growth of the diffusion of information and communication technologies represent the factors of the knowledge-based economy. Information technologies strengthen the intensity and variety of knowledge. The digital economy can be defined as all activities related to information and communication technologies (ICT) and the production and sale of digital products and services. The global economy is characterized by the transition to the fourth industrial revolution (Industry 4.0), which is accelerated precisely by digital transformation and global trends. Digital transformation is a process that is pursued by an organization when integrating digital technologies into all areas of business.

Each component of human capital affects other components; competences are based on individual characteristics, attitudes, abilities, and knowledge. They cannot exist if one of the components of human capital is missing. The concept of competence appeared in connection with the transformation of necessary knowledge into individual activities in new forms of work organization. An important task is the integration of knowledge and information into the standard economy. Skills and lifelong learning are fundamental factors in terms of competitiveness. Having the relevant skills means the ability to keep a job and handle job changes more easily.

Technological changes and the digital transition are causing a shift in the demand for skills. Skills increasing the workforce's ability to adapt to rapid changes in the economy and society include soft skills, STEM (Science, Technology, Engineering and Mathematics) skills and digital skills. Digital transformation affects all aspects of the labour market and life. Digital skills are important because they are fundamental to human interaction and modern work. For many professions, digital skills are simply foundational life skills.

Digital technologies as technologies with general applications affect all sectors of the economy. Digitization, like previous technological progress, will also have an impact on labour markets. Some jobs will be replaced, some jobs will be created, and many jobs will change.

The importance of digital technologies is growing namely for labour productivity, digital skills are becoming a driving force for employability. Most jobs require at least basic digital skills. Education and training policies, including the context of lifelong learning, tend to ensure that the workforce possesses the right skills to thrive in the digital world. As stated by [Dudová \(2022\)](#), a learning society corresponds to a universal society, which emphasizes the necessity for lifelong learning, especially regarding changes in technologies and jobs.

As stated by [CEDEFOP \(2022, p. 36\)](#), the complementarity between skills and digital technologies is manifested, the more qualified occupations are more digitally intensive. Digitally demanding jobs also require a higher complementarity of basic skills (e.g., literacy, numeracy), cognitive skills (e.g., problem-solving, creativity), and social skills.

The rapid change in the requirements for technical skills at work which has been observed in recent decades - reflecting the obsolescence and the necessity for the renewal of skills - indicates that the

pace of introduction of new technologies in the performance of work activities is high. According to the [European Commission \(2017\)](#), the challenges of digitization in the field of employment include a) replacement of jobs (some types of jobs may be replaced during the digital transformation of the economy); b) this may be most relevant to middle-level jobs (increased efficiency due to ICT has reduced the number of routine jobs in the middle part of the income distribution); c) the need to adapt.

3. IMPACT OF THE ANTICIPATED DIGITAL AND KNOWLEDGE TRANSFORMATION ON HUMAN RESOURCES IN THE SLOVAK REPUBLIC

The current development in the economy and society in the Slovak Republic brings in new technologies, innovations and trends that dynamically change the world and affect all areas of life. Informatization and digitization are changing the way economic value is created, the structure and functioning of markets, and ultimately how all relationships – economic and social – are created and developed. These changes are ongoing and affect an increasingly broad range of processes that are crucial for the functioning of businesses.

In terms of employment structure, out of the total number of approximately 2,604,000 workers, legislators and managers make up more than 5%, specialists and technicians, and professional workers make up 32%.

Table 1. Workers in the Slovak Republic according to the SK ISCO-08 employment classification (in thousands of persons)

Employment	2019	2022
1 Legislators, management workers	127,9	148,0
2 Specialists	348,9	411,5
3 Technicians and professional workers	406,0	438,1
4 Administrative workers	245,5	259,2
5 Workers in services and trade	475,7	435,4
6 Qualified workers in agriculture, forestry, and fishing	28,3	25,7
7 Skilled workers and craftsmen	407,9	384,7
8 Operators and fitters of machines and equipment	350,9	337,5
9 Helpers and unskilled workers	179,4	147,6
10 Members of the armed forces	13,3	15,2
Workers together	2 583,7	2 603,9

Source: [Statistical Office of the Slovak Republic, 2023](#)

It is assumed that with the advent of digitalization, many work processes will be automated and artificial intelligence will replace many activities. Achieved savings in human resources can create space for the emergence of new professions servicing new processes. Out of the total number of workers in the Slovak Republic, approximately 32% have a university education.

Table 2. Workers by education in the Slovak Republic (in thousands of persons)

Level of education	2019	2022
Primary	106,7	70,9
Vocational secondary (apprenticeship) without graduation	606,2	553,4
Complete secondary vocational (apprenticeship) with graduation	174,9	146,8
Complete secondary general education	104,7	109,7
Complete secondary vocational education	864,2	876,7
Upper secondary vocational education	22,2	20,1
University education – 1 st degree	81,7	101,6
University education – 3 rd degree	25,7	29,0
Without school education	-	0,3
Total	2 583,7	2 603,9

Source: [Statistical Office of the Slovak Republic, 2023](#)

In terms of employment status, employees make up 85% of the total number of workers and entrepreneurs 15%.

Table 3. Workers by employment status (in thousands of persons)

Employment status	2019	2022
Employees together	2 195,0	2 214,4
Employees in the public sector	695,3	728,4
Employees in the private sector	1 499,7	1 485,9
Employees in a state enterprise	695,3	728,4
Employees in a private company	1 452,0	1 437,7
Employees in a cooperative organization	30,3	21,6
Employee in another type of organization	17,4	26,6
Self-employed together	388,7	389,6
Entrepreneurs together	386,6	388,4
Entrepreneurs without employees	309,5	319,0
Entrepreneurs with employees	77,2	69,5
Helping members of the entrepreneurs' households	2,1	1,1
Workers together	2 583,7	2 603,9

Source: Statistical Office of the Slovak Republic, 2023

When analysing the potential of automation of internal company processes because of technological progress (robotization, artificial intelligence, digitization, etc.), it is always necessary to keep in mind basic economic laws. The fact that some parts of the process can be replaced by technology does not mean that it will happen. Even in times of technological progress, the company makes decisions based on profit, i.e., the difference between revenues and costs.

When intending to implement a specific technology in the production process, the company tries to influence the cost item. If the costs of the technology (investment and operating) are higher than the costs of human labour, the implementation of the technology may not be profitable for the company. Of course, other factors also enter this decision, such as the flexibility of capital and human labour (how operationally we can change process parameters), or the strategic intentions of companies.

Capital investment is frequently an investment with a long-term return and thus represents a certain amount of risk for businesses. Sometimes, companies, especially those without long-term strategic intentions, or full power over their future (they produce largely for other sectors and not for final consumers), do not pay to undertake an investment that in the more distant future will bring production efficiency at the expense of current profits.

According to the [Strategy for the development of human resources in the administration, economy, and management sector until 2030 \(2020\)](#), the main cost item of human labour is wages, which are the result of demand and supply in the labour market. If companies start to implement technologies replacing human labour on a larger scale and at the same time there is no demand for these workers elsewhere (in the Slovak economy), the wages for which these workers are willing to work will decrease at the same time.

This can again slow down technology implementation, as human labour becomes more profitable for the business than it was before technology implementation. This market principle and the profit motivation of businesses may prevent automation and robotization from having an extreme knock-on effect on the labour market and employees.

The most significant factors that affect the economic and social environment in the Slovak Republic include the increase in the competitive environment through innovative business models and digital solutions with an impact on the necessary qualifications to operate the solutions, the effects of fluctuations in the world and European economy, the defining of technology development trends along with the shift of the role Slovakia plays in supply chains, the need for manpower, public investments in research and development and the increase of lifelong learning rate. Economic factors include significant increases in productivity through technological change, lack of available skilled labour, and flexible work opportunities.

Digitalization and electronicization belong among the technological factors. Digitization in the field of services supports the erasure of geographical distances. Electronicization requires the increased qualification level of employees when performing specific activities in this area. With the advent of digitalization, many processes will be automated and artificial intelligence will replace a considerable number of activities in the sphere of administration, economy, and management. Predicted key innovation and technological changes in this decade that will impact human resources include digital ecosystems, advanced artificial intelligence and analytics, automation, Big Data, digitization, digital security, Internet of Things (IoT), communication networks of new generation, robotization, development of information technologies, artificial intelligence, etc.

The technological trends will manifest an accelerating impact on the entire economy and society that will continue to grow. The production processes and services of the modern Slovak economy will be subject to an increasingly high degree of digitization, virtualization, automation and robotization. Digitization and Industry 4.0 will require a deeper connection of ICT and business skills in the creation of innovative solutions.

Social factors affecting the labour market include mainly the demographic development of the workforce in terms of the availability of the workforce and the distribution of the qualification structure, especially in those sectors where the decline is most evident. In addition, experience shows that the presence of foreign workers in the labour market puts pressure on the adoption of new digital services and models from abroad.

As stated by the [Strategy for the development of human resources in the administration, economy, and management sector until 2030 \(2020\)](#), the legislative factors include, inter alia, the regulatory conditions for entry into the profession which must reflect the possibilities manifested by digital solutions, the support for the digital solutions in common commercial practice in the form of accelerating the digitization process in enterprises and the pressure for the transformation of the workforce.

Economic, technological, social, and legislative factors will influence the demand for specific employees or the required educational structure of the workforce in the future. Technological progress, together with the development of the sharing economy, will mean a significant transformation of the work environment. The mentioned innovations will have an impact on a wide range of jobs, even with the expected creation of new jobs in connection with the innovations.

Current technological and digital innovations will significantly affect the development of human resources. In this direction, several digital innovations are entering the processes, which have the potential to bring a breakthrough in the content of many professions. Not every innovation affects

individual sectors to the same extent. For example, certain professions will be replaced by artificial intelligence, which will create a substitute demand, especially for the skills of operating new software or systems which will represent the important competitiveness factor on which companies will depend. Technological changes will have a significant impact on the demand for professions with high added value and especially for the type of professional qualifications and IT skills.

4. HUMAN RESOURCES DEVELOPMENT TOWARDS THE KNOWLEDGE AND DIGITAL ECONOMY

Technological changes will have significant effects in relation to the demand for professions with high-added value. Technical skills in the areas of new technology management, programming and engineering are expected to come to the fore. The need for the development of soft skills and their innovation is expected, and the development of future competencies (characteristics, attitudes, innate or acquired knowledge and personal abilities leading to excellent performance). The understanding of competence is no longer tied to a specific qualification but goes beyond it.

It is assumed that the importance of competencies such as creative thinking, emotional intelligence, analytical skills (critical thinking), the ability for continuous learning and personal development, decision-making skills, and the ability to lead will grow. Digital communication, online internal and external communication, communication and project management, online education, leadership, and management were identified as innovations aimed at soft skills development.

According to the [Ministry of Finance of the Slovak Republic \(2022\)](#), public policies aimed at productivity increase will support digitization, including the completion of the infrastructure in areas not covered by the market, the improvement of digital skills of the current and future workforce, commissioning of effective electronic public administration that will provide services for citizens and entrepreneurs. Digitization will also take place in the field of healthcare, the judiciary, construction proceedings, the activities of Social Insurance, the fight against corruption, and the safety of the population. Digitization in education refers to the completion of the school's digital infrastructure and the strengthening of the digital skills of students in the new curriculum reform, including the preparation and professional development of teachers.

Building a high-quality digital infrastructure with the setting of rules for the use of open data by the private sector and non-profit organizations is considered an important aspect of supporting future development. Infrastructure development must also include investments in the workforce as a form of support for industry and modern digital services.

As stated by the [Strategy for the development of human resources in the sector of information technology and telecommunications until 2030 \(2020\)](#), the response of the Slovak educational system to innovations can be summarized as follows. Schools are adapting to digitization in education by changing teaching methods and forms, and applying distance and hybrid forms of education. The transition to distance learning required a reassessment of educational content - key skills are strengthened, and unnecessary content is reduced.

However, state educational programs do not respond sufficiently to innovations and the transition to distance education. The disproportion between the formal framework established by the state educational program and the real educational process in schools is growing. The shortage

of computer science teachers is causing schools to skip teaching this subject. Despite this, the founders of schools do not consider the lack of informatics teachers to be a serious problem as primary and secondary schools have a small number of informatics hours, which is not enough to employ a full-time qualified teacher, so the lessons are covered by unqualified teachers.

New technologies will permeate the economy and society. The transformation of the economy into a knowledge-based and digitally oriented one will require a massive transformation of knowledge and skills in STEM fields. The global impact of technological trends fundamentally changes the nature of work processes and operations, thereby creating the need for qualitative changes in IT skills and competencies. For that reason, systemic changes in all pillars of life-long education are necessary.

From the aspect of a strategic approach to the development of human resources, it is necessary to place particular emphasis on the following measures in the Slovak Republic:

- It is necessary to transform the educational system towards the acquisition of competencies necessary for the digital age. This includes, for example, defining a national standard for digital school, primary and secondary schools; comprehensive education and training of pedagogical and school employees in the transformation of education and schools for the digital age; legislatively and institutionally ensuring the recognition of partial qualifications in the ICT, digital and soft skills acquired through formal and informal education, as well as the acquisition of practical skills.
- Update, innovate and modernize the content of education towards the development of competences in pre-school education, primary, secondary, and higher education as well as in further education (e.g., strengthen the possibility of retraining adults in advanced digital and information technologies with their development over time).
- Improve and harmonize the infrastructure and technical equipment of educational institutions with technological trends.
- Initiate changes in the system of training and education of teachers, educators and lecturers of further education according to the requirements of the digital age.
- Build a culture of cooperation and networking to support the digitization of the society at large.
- Increase the motivation of the public, companies, and institutions to adopt and use new technologies and improve the awareness of the digital economy.

The global impact of technological trends and digitization creates an increased demand for a skilled IT workforce. Rapidly changing technological trends and the demands of the labour market make it difficult for the educational system to adequately adapt to these changes. The current resources of IT trained and prepared workforce, not only for the IT and telecommunications sector, but also for other sectors, are sufficient neither qualitatively nor quantitatively to cover the needs of the labour market, and this deficit will increase over time.

Many employers perceive the deterioration of the education system (with low flexibility and high inertia) to adapt to the rapidly changing demands of the labour market. In particular, the ICT sector requires the digital transformation of education and the introduction of fundamental innovations, such as a change of the paradigm of the educated individual as a subject of education to an object of education; a change in the perception of learning as a lifelong need of the individual, which enables to find the place in the world of work (the individual must take responsibility for his own education); opening and making educational systems and educational paths more flexible; wide use of digital and virtual learning environments; personalized and hybrid learning.

As part of other expected systemic changes in the system of lifelong education, the important change should relate to the development of mathematical and financial literacy, and soft skills acquisition, starting from preschool education. At universities, the development of STEM fields should be supported, and the increase of knowledge and practical use of information resources in study programs and specialized digital technologies, software and applications should be promoted.

5. CONCLUSION

Globalization, permanent and continuous progress in new technologies and the development of the knowledge economy are factors that force organizations of all kinds to innovate their work and management practices. However, the success of these innovations depends on the ability to rely on a healthy, skilled, and flexible workforce. Companies are embracing digital transformation to gain competitive advantage and relevance in the respective sector.

An important factor for the successful handling of future technological, social and economic challenges is an active, predictive and trend-aligned educational system and all educational activities (formal, informal and nonformal) in the context of the necessity of lifelong learning.

The development of human resources consists of the development of all characteristics of the organization's employees. It generally refers to the development of human capital, which aims to enable employees to improve their skills, know-how and competences. Technological progress in the workplace has a significant impact on the development of human resources. The problem of skills development in the internal environment of organizations and businesses will become more and more persistent, and their ability to evolve and adapt will become more and more important over time, as the digital transformation gradually comes in subsequent waves.

Social stakeholders (individuals, companies, the state) who deal with the generation and acquisition of knowledge, as well as the use and recognition of knowledge, should have a stake in the management of knowledge and education.

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