Public Goods and the Fourth Industrial Revolution

Inclusive Models of Finance, Distribution and Production

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Challenges for the education system in the era of the Fourth Industrial Revolution

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6.1 Chapter overview

Issues of education and social capital have already appeared in earlier discussions. The issue of education in the context of the impact of megatrends on public goods is discussed in Chapter 3, while the importance of social capital from the point of view of changes resulting from the Fourth Industrial Revolution (REV4.0) is explained in Chapter 1. The considerations contained in this chapter are an extension of the problems previously addressed, with particular emphasis on the impact of technological progress on the role of the education system in shaping and creating new competences.

Referring to the considerations presented in the previous chapters, it should be noted that the megatrends discussed in them affect the education system. Some of them have a major impact and we can expect that in the future they will significantly change the way education is produced, distributed and financed. There is no doubt that education is one of the most important areas of human life. The ongoing socio-economic changes, which are the result of technological progress, but also the aging process of the population, cause a continuous evolution of the functions of the education system and determine the horse's adaptation to changing realities. In particular, it is about changes taking place on the labor market, which on the one hand are the result of automation and robotization, and on the other hand, decreasing human capital resources and an increasing percentage of people of post-working age. Demographic change will have an impact on education in the future, which entails the need to adapt the education system to the change in the age structure of the population. In turn, due to the need to develop new competences, the education system will also evolve in terms of methods and curricula, while sustainable socio-economic development will increasingly depend on the competences of older people.

Therefore, bearing in mind the above observations, the detailed considerations presented in this chapter regarding the education system and its role in the formation of competences are preceded by an analysis of the evolution of the functions of education and key competences related to the lifelong learning process (LLL). Based on the educational policy objectives set at EU

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level, the authors focused their research on competences that are necessary in the era of socio-economic change. Thus, they attempted to identify competence gaps in the area of digital, cognitive and social competences, indicated in earlier considerations. Due to the fact that technological progress and digitization are becoming a huge opportunity for the development of social capital, used to effectively solve social problems, the impact of digital transformation on cooperation, trust and interpersonal relations (i.e. on social capital), was examined. An attempt was also made to determine the impact of digitalization on the education system and to identify the risks associated with this process.

6.2 Research methodology

The research assumption was made that REV4.0 and the accompanying changes have a significant impact on the education system. The research hypothesis assumes that the socio-economic changes resulting from REV4.0 require the redefinition of educational policy toward social inclusion.

The research hypothesis was subordinated to two main objectives of the work: methodological and application. The method adopted to achieve the above objectives consisted of combining theoretical considerations with empirical analyses. The methodological goal of the research was to develop a methodology and assessment of the level of digital, social and cognitive competences in the group of people 18–30 years old and the degree of use of digital tools in the education process. This objective is achieved by the development of a proprietary questionnaire, prepared on the basis of the literature review and EU documents, which enabled self-assessment of the level of competence of EU citizens using a coherent set of tools. Literature reviews and analysis of secondary data allowed for identifying competences necessary for the labor market in the era of REV4.0. First of all, the functions of the educational system were reviewed and, based on the documents of the EU institutions, key competences were identified that should be transferred in the LLL process, with particular emphasis on digital, social and cognitive competences.

In turn, the application is an attempt to determine, on the basis of the results of research, competence gaps of young adults, i.e. people aged 18–30. For this purpose, a Computer Assisted Web Interview (CAWI) survey was conducted via a web panel, which aimed to determine the socio-economic consequences of REV4.0 in the field of education. The research was conducted in the period from November to December 2020. In total, the research sample consists of 1000 respondents, selected by cohorts from among the panel participants. In order to analyze the results, statistical methods were used: Chi2 test for qualitative data of feature independence and discriminatory analysis. The sample is representative by age, gender and education (Table 6.1).

Table 6.2 presents the distribution of respondents according to the completed or studied field. 26% of respondents studied or graduated in economics, 24% in humanities (including law), 33% in science (mathematics, physics,

Table 6.1 Age, gender and education of respondents

Specification	*Gender*	*Age*		*Education*	
		18–24	*25–30*	*Average*	*Higher*
Women	524	52%	52%	42%	66%
Men	476	48%	48%	58%	34%
N	1000	399	601	575	425

Source: own study.

Table 6.2 Respondents by field of education

Specification	*Total*	*Women*	*Men*	*age 18–24*	*age 25–30*	*Average*	*Student*	*Higher*
economic sciences [%]	26	30	21	26	27	21	24	28
humanities [%]	24	28	19	23	25	29	20	26
science [%]	33	24	46	33	34	36	37	31
Other [%]	16	18	14	18	14	14	19	15
N	622	366	256	309	313	14	209	399

Source: own study.

engineering sciences, and computer science) and 16% represented other fields (medicine, tourism, physical education, etc.).

The analysis of the obtained results allowed determining the competence gaps of young adults in Poland. Due to the research methodology and its use of European indicators for the assessment of digital competences, as well as EU strategic documents in the field of education, it was possible to identify challenges for education systems taking into account the inclusive nature of educational services.

6.3 Evolution of the function of education and social capital

For a proper understanding of the role of education and social capital in human life, it is necessary, first of all, to recall the definition of education (for more, see Chapter 2). In antiquity, the definition of education was presented by Plato. According to him, education is "a lifelong process from birth until death" (Chandra and Shandra 2004, p. 1) and "causes a person to voluntarily strive to become an ideal citizen…" (ibid, p. 2). In the middle Ages, J.A. Comenius (ibid, p. 2) defined education as "the process by which a student developed religiosity, knowledge and morality, which allowed him to obtain the status of a human being." During the Enlightenment, J.J. Rousseau

promoted the principle of freedom in education (Rousseau 1979). In the 20th century, Huxley (1927), drew attention to the social aspects of education (Chandra and Shandra 2004). For the purposes of the considerations contained in this chapter, without entering into methodological disputes, the Authors adopted the broad meaning of education understood as "the totality of educational processes including education and upbringing as well as broadly understood educational activity" (Encyklopedia Popularna 2020, p. 200). In subject literature there exist much broader definitions of education, which is sometimes treated as (Encyklopedia Pedagogiczna 2003, p. 905):

- The process of permanent human learning throughout life,
- The right and at the same time the civil duty of man and the social imperative,
- An instrument of political power for the pursuit of specific interests and objectives,
- The area of social self-regulation, the main factor in the development of human capital.

Education has two main functions, i.e. socialization and liberating. The first is "to socialize the human individual, to make him capable of controlling and subliming emotionality in a socially acceptable way, to become a member of human society, to resolve conflicts by discursive means" (Encyklopedia Pedagogiczna 2003, pp. 905–906). The liberating function, on the other hand, boils down to "liberating people from social and environmental domination, to going beyond the status *quo,* to enable the development of the individual and to turn to new qualitative practices and forms of social and individual life" (Encyklopedia Pedagogiczna 2003, pp. 905–906).

Currently, the hierarchy of educational goals does not contain encyclopedic transmission of information, but the formation of attitudes in accordance with such features as activity, imagination, intellectual autonomy capability and continuous education (Kołaczek 2009). The perception of education by Banach (1998, p. 111), who defines it as "social value and capital and hope, as well as a large area of tasks, which should be in its goals and methods of work a serious opposition to many anti-values and negative phenomena and threats to human existence" seems to be correct.

The multifaceted nature of the concept of education is also evidenced by the multiplicity of factors that are associated with it. In Kwieciński's view, education in a broad sense is generated by the following processes (Encyclopedia Pedagogiczna 2003):

1 Globalization and related problems.
2 Statehood understood as the state, its sovereignty, system and democratic devices.
3 Nationalization and the resulting national traditions, cultural specificity, the essence of ties and distinctiveness.

4 Collectivization (secondary socialization) – existing social classes, class ties and interests, solidarity with people with similar positions.
5 Politicization, bureaucratization, professionalization – organizations and institutions; education for the division of labor, rationality and discipline in organizational society and in the institutionalized world.
6 Socialization (primary socialization) – the influence of primary groups: family, peer group and local community.
7 Enculturation and personalization – cultural and social personality, the human being as a result of growing into culture and autonomous choices of values.
8 Upbringing and juridification – implementation to the implementation and acceptance of civic roles and activities, shaping legal awareness.
9 Education and humanization – human as person, knowledge, worldview, skills, habits, dignity values, interactive competences.
10 Hominization – organism formation of human species characteristics, health, hygienic, sexual upbringing.

The progress of civilization and the socio-economic changes taking place mean that education is assigned ever wider and more complicated functions and tasks, in many respects incomparable to those implemented in the past. The importance of acquiring various skills and competences, and especially the need for further self-education, is increasingly emphasized (Encyklopedia Pedagogiczna 2003).

On the basis of practice, the concept of educational policy also acquires particular importance, understood as "the deliberate and organized activity of state and local authorities ensuring that children, youth and adults acquire knowledge, professional skills, develop personality and satisfy aspirations and aspirations" (Encyklopedia Pedagogiczna 2005, p. 524). One of the more important objectives of education policy is to compensate for different educational people from different environments and to find themselves at different stages of development, thus preventing various forms of exclusion.

According to Banach (1998), a key role of education policy is to define the goals, functions and tasks of education, upbringing and care, in different time horizons and show the ways of their effective implementation using tools such as law, institutions and organizations.

According to Biesta (2009), the educational system performs three basic functions. The first is for students to obtain qualifications by providing them with knowledge, shaping their skills and disposition, providing opportunities to form judgements, which are the basis for making decisions in the field of choosing a profession, learning contemporary skills, learning about contemporary culture, etc. The second function is socialization, in which, thanks to education, students are able to participate in relationships and social, cultural and political networks. Educational systems sometimes try to inculcate specific values (ethical, religious). The third function of education is subjectivization, which means developing in students certain independence in thinking and

acting in relation to the social, cultural and political systems in which they function. This function (independence of thought) is not accepted by all researchers, but there is a large group supporting this function (Peters 1976; Peters 1966; Dearden et al. 1972; Winch 2005). The issues of functions performed by the education system were also dealt with by:

- Chandra and Sharma (2004), who distinguished two groups of functions, i.e. the functions of education in the life of man and in the life of the nation,
- Lundahl et al. (2010), who analyzed them at the individual (individual) level and at the level of society,
- Ravi (2011), who divided the functions of the education system into: general; essential for the development and life of the individual; and the functions of education relevant to the nation.

Summing up these classifications, it seems that in a broad sense the functions of the educational system concern individuals, society and the nation. In terms of the functions that education performs toward the individual, these are: personal development, preparation for the duties that the student will have to perform in adult life. Harmonious development includes physical, aesthetic, intellectual, social and spiritual development, adapted to the needs of society. Functions toward society mainly include socialization. The educational system should provide students with the tools to shape their lives, personality, character and interaction with society. The functions of the educational system at the national level are designed to develop a sense of civil and social responsibility, leadership skills, and emotional integration as well as integration with one's nation. Education should allow students to break down barriers resulting from the place of birth, the social position of the family, religion and develop broad horizons of thought and a sense of social responsibility, thus being inclusive.

The presented definitions and functions of the education system allow us to state that it is a multilateral and complicated social phenomenon affecting many levels. It is an area of cooperation and coexistence, but also the confrontation of various entities, social groups in the formulation of goals, tasks, development programs of its organization, providing the necessary means and tools for their implementation, as well as assessing and measuring the effectiveness and quality of education. The main way to improve it, coherence and integration is to involve various educational entities in planning, organization of didactic and educational work and evaluation of results (Encyklopedia Pedagogiczna 2005).

Regardless of the way education is defined, it should be noted that every person has a potential called human capital, which consists of knowledge, education, skills, abilities, health, energy, motivation to work, needs, recognized values, etc. According to Jarecki (2003), this capital is used by individuals in work, which on the one hand allows satisfying material needs, and on the other hand allows expressing themselves, in the form of intangible

needs and values. The theory of human capital emerged in 1960, and its creator is considered to be T.W. Schulz, who also used the works of J. Mincer and G.S. Becker. This theory was enriched and comprehensively developed by Becker. Nevertheless, the problem of the place of the economic man in economic processes has been dealt with much earlier. This theory is of particular importance in the context of considerations concerning the importance of education and training for the income earned by individuals and its contribution to economic growth.

Mincer (1958) assumed that in the process of income distribution, the most important factors are related to the rational behavior of individuals. He introduced the concept of investing in human capital, by which he meant the so-called formal education (learning at school) and gaining professional experience. For Mincer, human capital is the sum of knowledge acquired at school and then in the course of work, and its measure is the duration of formal education and the age that reflects experience (Cichy 2005).

In turn, Schultz (1981) studied the issues of educational effectiveness. According to him, the decisive factor for economic development is an active person who can develop human capital through various investments, such as: raising and caring for children, own education and gaining professional experience, further education and developing their skills or taking care of their health.

Becker, on the other hand, presented a general theory of the formation of human capital, through the teaching and training of employees. He understood investment in human capital as the allocation of resources that affects future real income. For the creators of human capital, these investments were expenditure on, for example: education within the educational system, apprenticeships in enterprises, obtaining professional information and scientific research (Jarecki 2003). Becker considers education, training and health to be the most important of these. It is called human capital because people cannot be separated from their knowledge, skills, health or values in the way that they can be separated from financial and physical assets (The Concise Encyclopedia of Economics: Human Capital). However, Becker points out that formal education is only one way of investing in human capital, alongside opportunities for learning and acquiring skills in the workplace.

A review of the theory of human capital allows us to conclude that the most important place in it is occupied by education. According to Jarecki (2003), education affects not only the ability of a person to achieve higher incomes, but is important for the immaterial aspects of his life. A proper understanding of education is shown in the implementation and adaptation of new technological solutions and creations previously unknown. Education and competence have an impact on the speed and accuracy of decisions made and the correct interpretation of information. Progress is also the result of specific actions and expenditures of man, whose role is also creation. Therefore, man must have both the knowledge needed to process and interpret the information resource, as well as the production of new qualitative knowledge.

This particular role of education in the theory of human capital was also emphasized by other authors dealing with this issue in a later period. Their research focused on trying to assess the impact of education on economic growth. Names such as B. Weisbrod (1962), H. Uzawa (1965), Nelson and Phelps (1966), Y. Ben-Porath (1967), R. Lucas (1988), S. Rebelo (1991), J. Laitner (1993), Bils and Klenow (2000), R. Barro (2001), J. Temple (2001) and many others (Cichy 2005) can be cited here.

In considering education and the functions of the educational system, it is impossible not to refer to the concept of social capital, which is an interdisciplinary concept and therefore difficult to define. The first use this term was used by Hanifan (1916), who drew attention to the values and norms of social coexistence uniting the population of rural communities. However, unlike human capital, it is considered a new concept that gained importance in the nineties of the 20th century. Its essence lies in the separation of social relations as a factor influencing economic growth. The precursors of the inclusion of the term social capital in the scientific discourse are considered to be: P. Bourdieu, J. Coleman, F. Fukuyama and R. Putnam, whose concepts indicate the interdisciplinary nature of this concept. According to P. Bourdieu (1986), social capital is a private good and its size depends, on the one hand, on the number of contacts, and thus the size of the network of social relations, and on the other hand, on the size of the capital held by the members of these networks. For Coleman, social capital is manifested in trust, social norms, thanks to which interpersonal cooperation is possible (Bednarek-Szczepańska 2013). On the other hand, for Putnam, social capital is a cultural phenomenon, a resource of the community, not of the individuals who make it up. It includes standards supporting community cooperation and trust, which is the most important element of social capital (Czapiński 2008). Fukuyama defines social capital as a set of informal values and ethical norms common to the members of a particular group and enabling them to interact effectively for the public good, which is based on mutual trust of the members of the group (Czapiński 2008).

In contrast, the World Bank defines social capital as institutions, social relationships, networks, and norms that shape the quantity and quality of social interactions in society. All networks that share norms, values and agreements enable cooperation within and between groups (OECD 2001).

From the definitions presented, it follows that the main difficulty in defining social capital lies in the discrepancy as to whether social capital is a resource of individuals (a private good) or a collective (a public good – see more in Chapter 2). Since social capital cannot be classified either exclusively as a public good or as a private good, it can be defined as a kind of resource with the characteristics of a common good (Beerbohm and Davis 2017; Galston 2013). Every common good is at the same time public, but the public good does not have to be a common good. Social capital, unlike the public or private good, cannot be produced either by the state or by a private entity – it arises as a result of collective action. It is also not private property, because

entities cannot use it in any way, but must identify with certain values, comply with the rules and applicable norms in order for it to exist (Młokosiewicz, 2003).

The definition of common pool goods was introduced into economic theory by Ostrom, who in this way extended the dichotomous classification of goods into public and private by a new theoretical category of goods, drawing attention to factors previously overlooked in the consideration of the dilemmas of collective action within the framework of the so-called first generation of collective action theories – the importance of local knowledge and social capital (Ostrom and Ahn 2002).

Social capital is an intangible resource (Dodd 2014) capable of multiplying social and economic benefits by building relationships based on trust. Trust facilitates cooperation and affects the effectiveness of the group (network) and shapes social ties (Bugdol, 2010). "The essence of social capital is contained in the establishment of a public good serving society by building trust-based relationships that serve the common interests and increase efficiency of action" (Stanienda 2020, p. 63). Importantly, social capital creates the potential for action (Claridge 2020) and therefore its importance in the REV4.0 economy is growing. All the more so because a characteristic feature of the modern market is the decline in the importance of financial capital in favor of social capital, which becomes an important source of value creation. Entities cease to compete only on the use of tangible resources, but also focus their attention on intangible resources. "Only entities with a high level of social capital have a higher ability to innovate, gaining an advantage over competitors thanks to the rapid flow of information, knowledge and experience and skillful cooperation" (Przybysz 2012, p. 286).

There is a growing need for education in the area of developing social competences and preparing comprehensively educated and competent staff able to meet the challenges of the new economy. Digital transformation is becoming a huge opportunity in the development of human capital, but also social capital, which is used to effectively solve growing social problems through the process of social inclusion, understood as the process of improving the conditions for participation in social and economic life by individuals and groups (World Bank Group 2021). The growing role of automation and artificial intelligence (AI) and the associated opportunities and threats were pointed out by Ransbotham et al. (2019). Human labor cannot be fully replaced by machines or AI, but automation and robotization have a significant impact on the labor market, as a certain part of society is resistant to the changes taking place and thus most at risk of educational and social exclusion (PARP 2020a).

Changes in the development and perception of the importance of social capital in economy 4.0 have been accelerated by the Covid-19 pandemic. It has contributed, m.in, to reducing individualistic behavior, developing a willingness to compromise, a critical approach to values, as well as increasing social cooperation and engagement in relationships in order to relearn

Table 6.3 Assessment of the impact of technological progress on the development of co-operation, trust and interpersonal relations

Competence	*1 – definitely do not affect*	*2 – rather do not affect*	*3 – hard to say*	*4 – rather affect*	*5 – definitely affect*
Cooperation	2.4	5.1	23.3	39.1	30.1
Trust	4.3	12.8	27.7	29.9	25.3
Interpersonal relationships	4.8	10.7	24.6	29.5	30.4

Source: own study.

cooperation. Citizen networking has increased significantly and social contacts have been strengthened online using various messengers m.in: YouTube, Twitter, Instagram, Facebook, Zoom, Skype, MS Teams, own applications. The following forms of cooperation have been strengthened: crowdsourcing, crowdfunding and fundraising. OECD research (2019a) has shown that online social networks strengthen social capital. The characteristics identifying social capital have also changed, i.e.: the level of trust, mutual relations, the strength and intensity of cooperation and the scale of benefits of cooperation after the Covid-19 pandemic. In order to verify the secondary data, their own research was carried out, in which the opinion of young adults on the impact of manifestations of technological progress on social capital was examined: co-operation, trust and interpersonal relations (Table 6.3).

69.2% of respondents believe that technological progress is changing the way people work together, 57.6% believe that the way trust is built has changed and 54.1% believe that the nature of interpersonal relationships is changing. The distribution of answers to all three questions did not depend on the level and profile of education, nor on age. It should be noted, therefore, that although the concept of social capital is considered to be relatively new, due to the changes taking place and the progress of technology, it is continuously evolving. This is due to the change in its meaning in a globalized world in which the basic form of communication is online communication. In this way, by building trust and cooperation with the use of digital tools, social capital counteracts the processes of social exclusion.

In view of such a picture, in REV4.0, there is an urgent need to develop new social competences to address the growing difficulties associated with complex societal problems (Hausner et al. 2017), which carry the risk of widening skills gaps, greater inequality and wider polarization (WEF 2018). AI is not able to replace a human in all areas, especially those based on trust, cooperation, building relationships, expressing emotions. Social capital thus becomes a key resource of the organization in the situation of dealing with change, building openness in the face of uncertainty. It can be concluded that social capital plays an inclusive role by creating opportunities for full participation in economic, social and cultural life (WEF World Economic Forum 2018).

The process of inclusivity (inclusion) should be strengthened by education, the aim of which must be not only adaptation to the changing reality, but the idea of human integrity and comprehensive development. Education 4.0 is about combining the real and virtual worlds in order to raise the level of competences not only personal, but also technical and social using modern digital tools offered by REV4.0 (WEF World Economic Forum 2018).

6.4 The education system and its role in creating new competences

6.4.1 Competences of the future

One of the important elements of EU policy is education policy, which is fundamental for socio-economic development. It requires constant adaptation to modern changes and market requirements. The EU's objectives related to education policy were defined in treaty documents, developed in the Lisbon Strategy and continued in the Europe 2020 strategy (European Commission 2010).

The Education and Training 2020 program assumes that the framework for cooperation in the field of education is those against four strategic objectives (Council of the European Union 2009):

- Implementation of the concept of lifelong learning and mobility,
- Improving the quality and effectiveness of education and training,
- Promoting equality, social cohesion and active citizenship,
- Enhancing creativity and innovation, including entrepreneurship, at all levels of education and training.

Within the framework of the objectives of the European Education Area defined in such a manner, the European Commission has set itself the main task of supporting the development of key competences in the lifelong learning (LLL) process. Key competences are defined as a combination of knowledge, skills and attitudes, whereby (Recommendations Council 2018):

- Knowledge consists of facts and figures, concepts, ideas and theories that are grounded and help to understand a specific field or issue,
- Skills are defined as the ability and ability to implement processes and use existing knowledge to achieve results,
- Attitudes describe the willingness and willingness to act or respond to ideas, people, or situations.

The implementation of key competences plays an important role in EU education policy based on the concept of a knowledge-based economy (Mohajan 2017) and REV4.0-related processes such as the growing number of jobs subject to automation, the growing role of technology in all areas of work

and life, and the increasing importance of social, civic and entrepreneurial competences (see more: Chapter 1).

The recommendations of the EU Council define key competences as having the need for self-fulfillment and personal development, employment, social inclusion, sustainable lifestyles, successful living in peaceful societies, managing life in a health-promoting way and active citizenship. At the same time recognizing that skills such as critical thinking, problem solving, teamwork, communication and negotiation skills, analytical skills, creativity and intercultural skills are part of all key competences (Recommendations Council 2018). These competencies include: understanding and creating information; multilingualism; mathematics; competences in the field of natural sciences, technology and engineering; digital; personal, social and learning skills; civic; in the field of entrepreneurship; in terms of cultural awareness and expression.

In 2020, the European Commission presented the European Skills Agenda for Sustainable Competitiveness, Social Fairness and Resilience, (European Commission 2020b). The Agenda is a five-year plan to develop skills that strengthen sustainable competitiveness, ensure social justice in line with the European Green Deal, deliver on the first principle of the European Pillar of Social Rights: access to education, training and lifelong learning for all across the EU, and build resilience to respond to crises based on lessons learned during the Covid-19 pandemic. It sets four goals for 2025 aimed at lifelong learning, as well as the development of skills necessary for the work of the future, including digital competences. The Covid-19 pandemic has proven that digital competences are not only an element needed for professional development and ensuring work in the future, but are also necessary to perform remote work, education, access to goods and services, maintain social ties and obtain information about the world.

Skills are defined in a slightly different way by the OECD (2019b), distinguishing 4 groups of skills:

- Basic – skills of understanding and creating information, mathematical and digital,
- Transversal cognitive and metacognitive – critical thinking, comprehensive problem solving, creative thinking, learning and self-control,
- Social and emotional – conscientiousness, responsibility, empathy, self-efficacy and cooperation,
- Professional, technical and specialist knowledge and skills needed to meet the requirements of specific professions.

The OECD Skills Survey presents strategic approaches to skills policy. Their results include internationally comparable indicators and policy analysis in the areas of: quality of education and curricula; entering the labor market; vocational education and training; employment and unemployment; innovative learning in the workplace; entrepreneurship; and matching skills with professional requirements (OECD 2021). The OECD's Skills Strategies assesses

skills challenges and opportunities in individual countries in order to create effective skills education systems. This approach is based on the OECD Skills Strategy Framework, which includes three elements: developing the skills needed throughout life; effective use of skills at work and in society and improvement of the management of skills systems (OECD 2019b).

Figure 6.1 presents the results of research on the level of key indicators of skills development in Poland compared to OECD countries. The differential presents 18 aggregated key indicators of the development of selected skills from among all respondents. The basis for the construction of the differential was the arithmetic mean of the respondent preferences, included on a scale from 0 to 10 (0 – low, 10 – very high). Skills development indicators in Poland are below the average levels achieved in OECD countries. A particularly low level of problem-solving skills is observed. Within PISA (Programme for International Student Assessment), which measures the ability of 15-year-olds to use their knowledge and skills in reading, math and science, only the 3-year average trend is much higher than the average level for OECD countries. At a similar level (in Poland and OECD countries) there are indicators on adult literacy. In addition, Poland scores very low in digital skills – about 50% of adults have no experience or have only limited experience in using computers or do not believe in their ability to use computers. For comparison, in other OECD countries, adults account for only 25% (OECD 2016).

Due to this level of skills development, solutions for the development of new competences covering all levels of education, training and labor market policy areas have been introduced in Poland. The solutions adopted in the form of the Integrated Skills Strategy 2030 (2020) are based on the requirements of the Partnership Agreement, the recommendations for Poland in the field of skills formation (OECD 2019c) and the assumptions of the new European Skills Agenda (European Commission 2020b). The Strategy defines eight areas, objectives and activities related to skills formation. They indicate the need to equip Polish society with solid and diverse cognitive, social, emotional and professional skills. These areas include skills development in:

- Basic, transversal and professional children, adolescents and adults,
- In formal education – management and teaching staff,
- Outside formal education,
- In the workplace,
- Career guidance,
- Planning lifelong learning and validating skills.

When trying to assess the development of competences in Poland, it can be concluded that their implementation is an extremely difficult process. As Hausner (2020) notes, this is mainly due to the possibility of defining only strategic directions for the development of the education system, and not creating a detailed universal operational program, the implementation of which would ensure the achievement of the desired results.

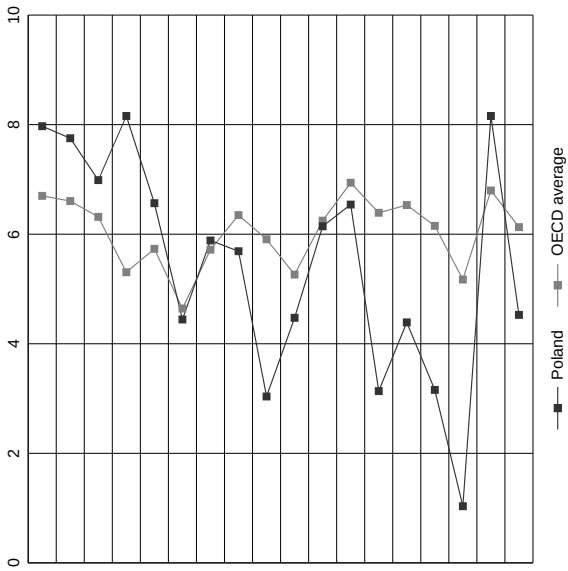

Figure 6.1 The level of key indicators of skills development in Poland compared to OECD countries.

Poland faces a number of complex challenges in developing and shaping the skills of its citizens. Skills disparities remain high. Some graduates enter the job market without a strong and comprehensive skill set. Many adults have a low level of skills, but most of them do not take part in education and training and the LLL. Importantly, companies also do not engage in education and training and do not fully exploit the potential of worker skills to support productivity and innovation (OECD 2019c).

According to Hausner (2020), the competences of the future are mostly unknown, but in the context of the ongoing changes related to REV4.0, it is necessary to acquire new competences and deepen those possessed, as well as actively engage in social life. The idea of LLL is essential to ensure high flexibility of society in this regard.

Another problem studied was the knowledge of the concept of the REV4.0. Respondents were asked about their awareness and could answer "yes" or "no." Of the 1,000 people surveyed, 440 said they knew the term REV4.0, and 560 people said they didn't know it. The distribution of responses was not significantly dependent on the field of study, but depended on the age of the respondents ($p = 0.00005$) and on the level of education (Table 6.4). Respondents aged 18–24 had a much better recognition of the term REV4.0 (out of 401 people, as many as 51.87% knew the term). In the 25–30 year old group of 599 people, only 38.9% knew the date of the REV4.0. The differences between the age groups were statistically significant, i.e. the five-year age difference significantly affected the level of knowledge in this area.

Table 6.4 presents the distribution of responses according to the level of education. Also here a statistically significant difference is visible, especially between people with secondary education and students and people with higher education. Only 35% of people with secondary education were familiar with the concept of REV4.0, for students it was 53.78%, and for people with higher education 46.23%. The level of education significantly increased the knowledge of the term of the REV4.0, although in general it was low.

Another question from the survey important for the conducted analyses was the question about the concepts that the respondents associate with REV4.0. The only answer indicated by over 50% of respondents (67%) was "the development of modern technologies such as cloud computing, Big Data or the Internet of Things." Other terms that are also related to REV4.0, were identified by less than half of the respondents, and these were:

- Moving to innovation based on combinations of technologies (42% of respondents),
- Development of smart cities, homes and autonomous cars (49% of respondents),
- Digital, social and cognitive competences allowing to function in a digitized world (46%),
- Lifelong learning (13% of respondents).

Table 6.4 Knowledge of the Fourth Industrial Revolution and the level of education

Level of education		*No*	*Yes*	*Together*	*Chi2*
Average	N	123	228	351	$chi^2 = 21.48496$
	%	35.04%	64.96%	100%	df = 2
Student	N	128	110	238	p = 0.00002
	%	53.78%	46.22%	100%	V-Cramer = 0.1465775
Higher	N	190	221	411	
	%	46.23%	53.77%	100%	
Together	N	441	559	1000	

Source: own study.

Another important question from the point of view of the discussed issues was the question of the driving forces of the REV4.0. In this case, it examined what concepts respondents associate with REV4.0. The driving forces that were asked about were: quantum computers, autonomous vehicles, 3D printing, robotization, artificial intelligence, Blockchain technology, the Internet of Things, smart cities and homes. The concepts that respondents most connected with REV4.0 were autonomous vehicles, 3D printing, and artificial intelligence. In their case, more than 50% of the respondents knew these concepts well or very well. Most of the respondents, 63.2% of REV4.0 respondents associated with the concept of artificial intelligence. The distribution of responses depended only on the age of the subjects (p = 0.00123). Definitely this concept was more recognized by younger people (age 18–24). However, the least associated with REV4.0 was Blockchain technology. Only 14.6% of respondents knew this concept well or very well, and as many as 66% did not know it. It may be due to the fact that it is a relatively new technology and requires highly specialized knowledge, which is also not directly available to the general public. This thesis is confirmed by the distribution of answers, which depended on the profile of studies (p = 0.00003). This concept was best identified by people studying in fields of economic and scientific profile. To an equally low extent, respondents connected quantum computers to REV4.0. Only 21.1% of respondents knew this concept and, as in the case of Blockchain technology, the distribution of responses depended only on the education profile (p = 0.000001). Greater knowledge of quantum computers has been observed in people studying science.

It can therefore be concluded that the very concept of REV4.0, as well as the accompanying technologies, referred to as driving forces, is relatively poorly known. The greatest knowledge of these issues was shown by young people and those studying in the field of exact sciences. This should be considered worrying, as these technologies will increasingly be widely used in the socio-economic environment and therefore knowledge of them will be essential. Otherwise, the digital exclusion already observed today may affect an increasing part of society in the future. That is why it becomes so important to

open up the education system to the elderly and intensify activities involving their inclusion in the LLL process. According to the report by Dynowska-Chmielewska et al. (2020), as a result of the development of information technologies, including artificial intelligence, there will be a radical increase in automation and robotization. Therefore, hard competences will be crucial – STEM (science, technology, engineering and mathematics) (MEN 2020), the importance of which is also emphasized by the European Commission.

6.4.2 Digital competence

Since 2006, both at EU level and in national policies, digital competences have been one of the key competences to be developed in the LLL process (Recommendation of the European Parliament and of the Council, 2006). In the literature on the subject, they are defined in different ways. According to Ala-Mutka (2011), they contain instrumental knowledge and skills in using digital tools and media, advanced skills and knowledge needed for communication and cooperation, information management, learning, problem solving and effective participation in the digital world, as well as attitudes toward the use of strategic skills in an intercultural environment in a critical, creative, responsible and autonomous way. This concept of digital competences is of a general nature (that is, it does not focus on the workforce) and must be adapted to specific target groups, which corresponds to the postulate of Hoel and Holtkamp (2012) to take into account the specific context, when defining digital competences. In turn, Ferrari (2012) presented a definition of digital competences based on the analysis of 15 cases (e.g. school curriculum designs, certification systems) (Figure 6.2).

Digital competence according to Ferrari (2012) is a set of knowledge, skills, attitudes, strategies, values and awareness that are required when using information and communication technologies (ICT) and digital media to:

- Perform tasks, solve problems, communicate, create and share content and build knowledge in a way that is: effective, efficient, relevant, critical, creative, autonomous, flexible, ethical, reflective,
- Work, leisure, participation in digital life, learning, socializing, consumption and empowerment.

The European Commission, on the other hand, defines them as "confident, critical and responsible use of and interest in digital technologies for the purposes of learning, working and participation in society" (Recommendations Council 2018, pp. 1–13). In its 2018 Communication on the Digital Education Action Plan the Commission points to the need to "stimulate, support and increase the use of innovative and digital educational practices" (ibid.). The DEAP focuses on two strategic areas: supporting the development of an effective digital education ecosystem and developing digital competences and skills specific to the era of digital transformation (European Commission 2020a). The plan aims

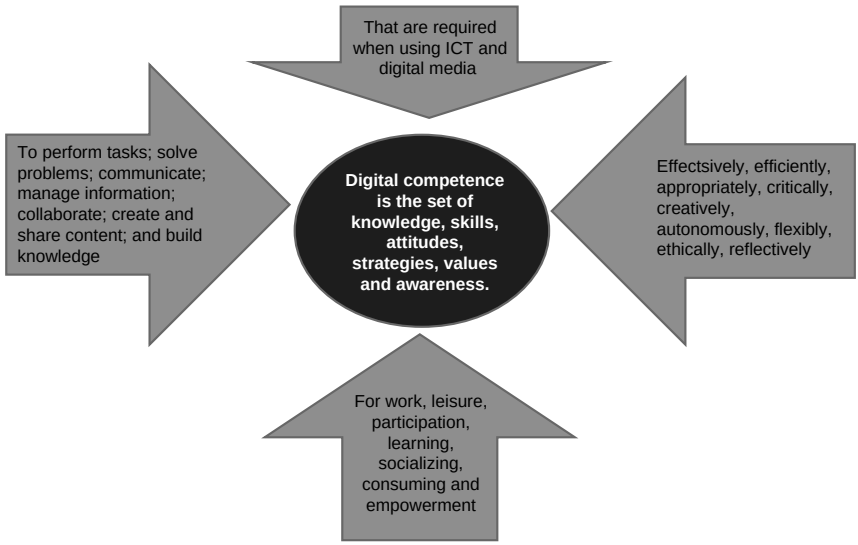

Figure 6.2 Digital competence according to A. Ferrari.

Source: own study based on: Ferrari 2012.

to work more closely together at European level, taking into account the impact of the Covid-19 crisis, during which technology has started to be used on an unprecedented scale in education and training. Actions for the development of digital competences, taking into account the European objectives, are also undertaken in individual countries. For example, in Poland, as part of the new core curriculum, programming was introduced from an early age at school and the number of hours of computer science was increased.

However, it should be emphasized that the first document on digital competences – The European Digital Competence Framework (DIGCOMP) was published in 2013 (Ferrari 2012) and has been amended many times since then. DIGCOMP is a tool for developing citizen digital competences at European level as well as in individual countries. In this document, digital competences are grouped and covered in five areas: data and information literacy, communication and collaboration, digital content creation, security and problem solving. A person with digital competence is considered to be a person who moves smoothly within these five areas and is able to use the functions of digital technologies. Therefore, the assessment of digital competences at individual stages of education becomes paramount.

From the point of view of the implementation of the educational process using technology, the digital competences of teachers are of particular importance. Teacher understanding of these competences is presented in the European Framework for the Digital Competence of Educators, DigCompEdu (Redecker

2017). This is a general reference framework to support the development of digital competences specific to teachers in Europe at all levels of education, including adult education, general and vocational education and training, education for people with special needs, as well as non-formal learning. These competencies are also included in the European Framework for Digitally Competent Educational Organizations (DigCompOrg). Based on this document, there is also an online tool that allows self-assessment of SELFIE schools and identification of their strengths and weaknesses in the area of digital technologies. It is also worth noting that this tool is free of charge (Self-reflection on Effective Learning by Fostering the Use of Innovative Educational Technologies, DigComp/SELFIE 2021).

This European Reference Framework (DigComp, DigCompEdu, DigCompOrg/SELFIE) aims to create a common ground for dialogue and competence development at national, regional and local level. They also have a transnational dimension, as they enable self-assessment of citizens, pupils (DigComp), educators (DigCompEdu) and schools (DigCompOrg/SELFIE) through a coherent set of tools. In the context of these documents, it is important that teachers do not have to be fluent in all modern tools, but rather the need for openness on their part to innovative teaching methods and their advantages is indicated.

Taking into account the fact that DigComp were developed in order to allow EU citizens to self-assess their skills in terms of their digital competences, the competences specified in the document were used for the research conducted in Poland. Respondents were asked to rate 21 digital skills and their answers are presented in Figure 6.3.

It is important to underscore that the overall assessment of digital competences is lowest within the three types of competences studied, i.e. social, cognitive and digital. Only 56.9% of respondents said that they have these competences to a high or very high degree, while to an average level 29.6%, to a low or non-low degree, 10.4% of respondents have them. This means that respondents are aware of insufficient knowledge and skills in the area of new technologies and their use. Undoubtedly, this is a positive phenomenon, and shows the directions of changes in the education system and the need to intensify activities to improve these competences m.in. by participating in the LLL process. Of the 21 skills surveyed, the respondents had the ability to browse, search, and filter information on the Internet to the greatest extent. As many as 77% of respondents said that they have it to a high and very high degree, and only 3.4% to a low degree or do not have it. Importantly, the distribution of responses depended only on the level of education ($p = 0.00865$). The higher the respondent's education, the higher s/he will assess his competences (Table 6.5).

The respondents also rated highly the ability to: assess the reliability and usefulness of information on the Internet; compare different sources of information; store information, share information and resources, and the ability to communicate using digital tools and applications. These skills were declared to a high or very high degree by over 70% of respondents. For three of these

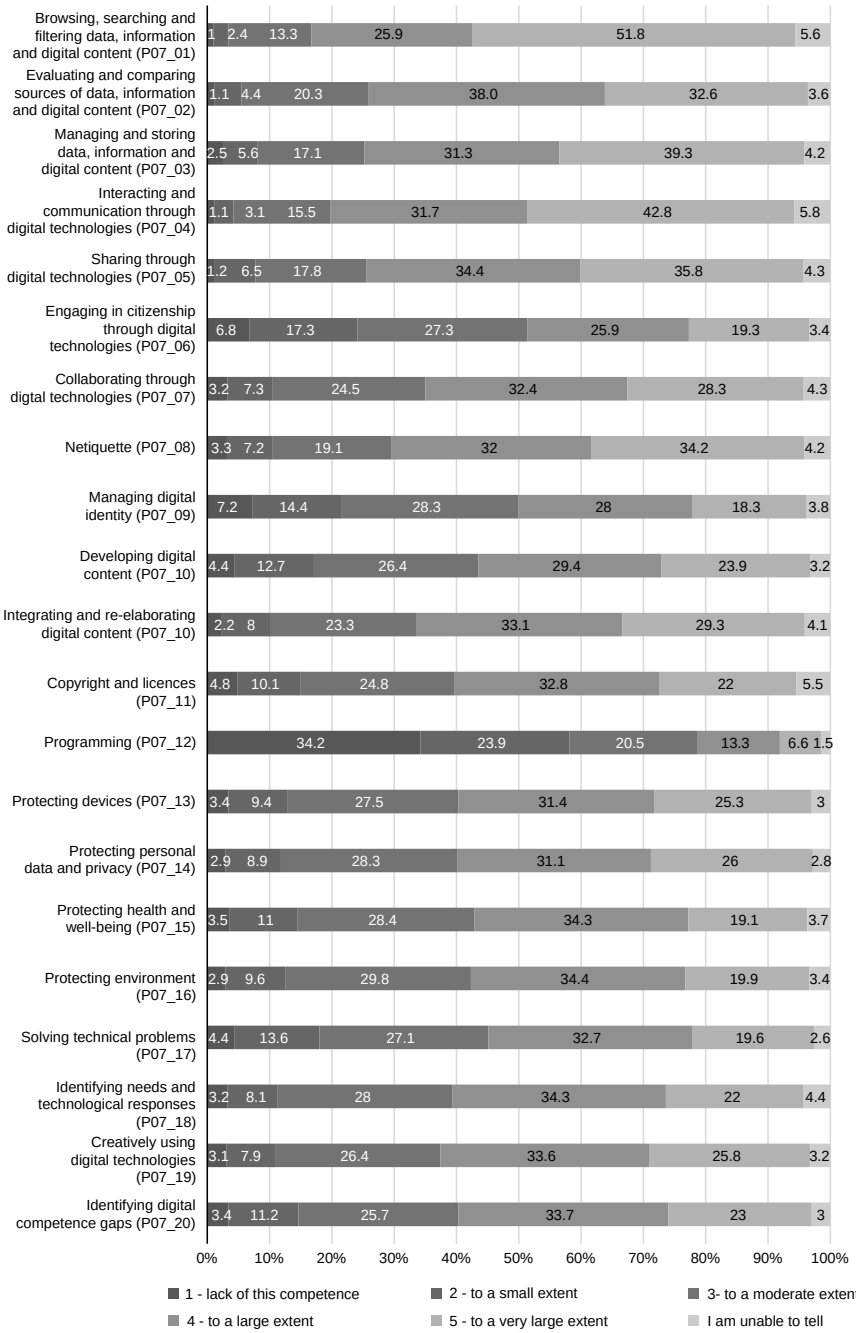

Figure 6.3 Self-assessment of the level of digital competences (in %).

Source: own study.

Table 6.5 Ability to browse, search, filter information on the Internet, and the level of education

Level of education		*1 – I do not have*	*2 – I have a low degree*	*3 – I have a medium degree*	*4 – I have a high degree*	*5 – I have a very high degree*	*I can't judge*	*Together*	*Chi2*
Average	N	6	9	58	96	158	24	351	chi2 = 23.62689
	%	1.71	2.56	16.52	27.35	45.01	6.84	100	df = 10
Student	N	2	7	36	61	116	16	238	p = .00865
	%	0.84	2.94	15.13	25.63	48.74	6.72	100	v-Cramer =
Higher	N	2	8	39	102	244	16	411	0.1086897
	%	0.49	1.95	9.49	24.82	59.37	3.89	100	
Together	N	10	24	133	259	518	56	1000	

Source: own study.

four skills (the exception was communication skills), the distribution of responses depended on the level of education ($p < 0.005$). The higher it was, the higher the assessment of the level of competence. On the other hand, the respondents rated their programming skills therefore. Only 19.9% of respondents said that they have it to a high or very high degree, and as many as 58.1% said that they have it to a low degree or do not have it. Slightly better is the self-assessment of respondents in the case of such skills as: digital identity management, creating online content. Having these skills to a high or very high degree was declared by 45% to 55% of the respondents. Similarly, respondents assessed their compliance with copyright and licenses (54.8% of respondents indicated that they have high or very high skills in this area). Over 50% of the respondents also have the ability to solve technical problems, competences in the field of health care (e.g. the ability to: apply ergonomic principles of work in front of a computer), as well as competences related to environmental protection (e.g. the ability to: identify positive and negative aspects of the use of technology). It is also worth emphasizing that the answers in the case of digital identity management and environmental protection did not depend on the field of study, level of education or age. The level of education depended on the distribution of answers to assess the level of competence in the field of: creating internet content ($p = 0.01246$), programming ($p = 0.00142$), health care (0.00918), solving technical problems ($p = 0.0383$). Respondents rated their skills higher along with the increasing level of education. Only in the case of technical problem-solving skills was this relationship reversed, i.e. the skills of the subjects were higher in the case of people with secondary education. In addition, the distribution of answers regarding programming skills ($p = 0.00004$) and solving technical problems ($p = 0.00007$) was influenced by the field of study. Higher, people with exact education assessed their skills.

On the other hand, when it comes to skills, for which the most respondents indicated low or did not have them, these were: digital identity management (21.6%), web content creation (17.1%), compliance with copyright and licenses (14.9%), programming (58.1%) and health care (14.5%). Therefore, it can be concluded that on the one hand, nearly more than half of the respondents have these skills, but the percentage of people who do not have them is also high. Young adults rated their competences in the field of programming the lower and at the same time most respondents do not have them at all (34.3%).

Taking into account the five previously mentioned areas of DigComp digital competences (information, communication, content creation, security and problem solving), the respondents rated their competences the highest in the case of the first two. On the other hand, the least skills the respondents had in the field of content creation and security. This represents a competence gap that implies an intensification of efforts to develop digital competences. Despite the existence of many programs, both at EU level and in individual countries, aimed at improving these competences, their deficit is indisputable. Especially if we take into account the fact that a person who has digital competences is considered to be a person who moves fluently within these five areas, and not only able to use the functions of digital technologies. It is also worth noting that formal education does not provide opportunities for comprehensive acquisition of these skills. Hence, it is important to engage in the process of transferring these competences also by entities outside the formal education system. This includes both public institutions that may be responsible for financing training from public funds, as well as private entities, e.g. employers. The role of the latter is particularly important due to the fact that by investing in human capital, they affect the efficiency of enterprises, but at the same time by equipping employees with appropriate competences, they reduce the negative effects associated with cybercrimes. To reduce the risk of digital exclusion of economically active people requires taking action for the development and improvement of digital competences outside the process of formal education, and that can be done by means of intensifying the LLL process.

In order to determine the impact of individual digital competences on their overall assessment by respondents, linear discriminant analysis (LDA) was used (Table 6.6). Discriminatory methods are designed to determine which of the available variables most strongly differentiate groups of objects formed due to certain known characteristics.

Suppose we have a set of observations for a $\vec{x}$ sample of objects that we know which class they belong to. This set will be called a learning set. The task of the LDA algorithm is to find such a function that will effectively predict which observations from the same distribution will belong to the class y (the function is to be created solely on the basis of a known set $\vec{x}$). That is, the random observation X comes from one of the classes K. The chances of belonging to each class are determined by the probability density function f(x)

Table 6.6 Linear discriminant analysis forecasting general self-assessment of digital skills

N=1000	*Wilks Lambda*	*Wilks particle*	*F-to-remove (5,974)*	*p*	*Toler.*	*1-Toler. (R-quad)*
P07_01	0.519587	0.996634	0.657855	0.655559	0.576371	0.423629
P07_02	0.521213	0.993525	1.269592	0.274786	0.629911	0.370089
P07_03	0.519772	0.996279	0.727475	0.602889	0.652757	0.347243
P07_04	0.525889	0.984691	3.028493	0.010155	0.670869	0.329131
P07_05	0.521594	0.992799	1.412964	0.216937	0.620621	0.379379
P07_06	0.520045	0.995757	0.830093	0.528308	0.706836	0.293164
P07_07	0.522318	0.991424	1.685079	0.135425	0.607219	0.392781
P07_08	0.522913	0.990296	1.908869	0.090287	0.650702	0.349299
P07_09	0.529468	0.978034	4.375019	0.000606	0.690234	0.309766
P07_10	0.522125	0.991790	1.612603	0.153927	0.699476	0.300524
P07_11	0.521612	0.992766	1.419513	0.214562	0.615953	0.384047
P07_12	0.518523	0.998679	0.257601	0.936046	0.724738	0.275262
P07_13	0.525858	0.984748	3.017021	0.010394	0.760813	0.239187
P07_14	0.521547	0.992889	1.395106	0.223530	0.618106	0.381894
P07_15	0.521116	0.993709	1.233179	0.291342	0.607713	0.392287
P07_16	0.523217	0.989720	2.023446	0.072985	0.690792	0.309208
P07_17	0.520978	0.993973	1.181093	0.316402	0.676820	0.323180
P07_18	0.527363	0.981939	3.583057	0.003235	0.708716	0.291284
P07_19	0.535749	0.966569	6.737646	0.000003	0.661061	0.338939
P07_20	0.520629	0.994640	1.049749	0.386984	0.631279	0.368722
P07_21	0.524349	0.987584	2.449128	0.032300	0.649585	0.350415

Source: own study.

specific to a given class. The probability density function takes as an argument the value vector describing a given observation X and determines the probability that this observation X belongs to this class. Density functions are constructed in such a way that they share a multidimensional space in which observations on K of disjoint regions are located (Cohen et al. 2003).

The forward step method used in the calculations means that before the discriminatory functions were calculated, the usefulness of subsequent variables in the model was studied. If adding a variable did not improve the model, then such a feature was removed. The Wilks test was used to assess suitability of variables. The Wilks test is based on the so-called intergroup variance and intragroup variance. The idea is that there should be a significant difference between the level of variance between objects within a class and the level of variance between classes. In other words, objects in individual classes should be similar to each other (low intra-class variance) and objects from different classes should be significantly different from each other (high interclass variance). Wilks statistics are tested using F statistics to see if it is statistically significant. If the value is statistically significant, it means that the differences between classes calculated by means of a discriminatory function based on a certain group of characteristics are significant.

Table 6.6 shows that the overall assessment of the level of digital competence possessed is strongly related to the skills of:

- Communication using digital tools and applications (P07_04),
- Digital identity management (P07_09),
- Programming (P07_013),
- Solving technical problems (P07_18),
- Identifying the needs and tools necessary to solve problems (P07_19),
- Identifying digital competence gaps (P07_21).

The overall assessment of digital competences is most influenced by the skills that come with expertise. While communication via the Internet is necessary, especially in the era of the Covid-19 pandemic, due to professional work, education and social contacts, other skills allow not only being the recipient of content, but also to actively create and manage it. The conducted research clearly indicates that the greatest deficit of digital competences occurs in the area of content creation and security. It is also important that the overall assessment of competences is determined by the ability of the respondents to identify competence gaps. This indicates the awareness of competence deficits and at the same time is the basis for their further raising and development.

6.4.3 Social competences

The current megatrends and the socio-economic changes resulting from them indicate the need to develop not only hard competences, but also those that focus on human behavior, attitudes, way of communicating, independence, i.e. social and cognitive competences. To function in the modern labor market, such competences as emotional intelligence, trust, the ability to cooperate, establish contacts and maintain long-term relationships are necessary. The challenge in the education process is therefore that of flexibility, and the most important skills are those that are associated with continuous adaptation to new conditions (Bauman 2006), in accordance with the expectations of the market, i.e. the ability to constantly learn, the ability to adapt to work in new teams, in a changing environment (Janowska and Skrzek-Lubasińska 2019).

In order to identify gaps in the social competences of young adults, respondents were asked about the level of their competences and their assessment of the degree to which the education system in Poland develops these competences. Figure 6.4 presents an assessment of the level of individual social competences of respondents.

To the greatest extent, the respondents declared the ability to work effectively in a team, emotional intelligence and the ability to build relationships based on trust. More than 60% of respondents considered that they have them to a high or very high degree. When it comes to self-assessment of the ability to work effectively in a team, the respondent responses depended on the level of education ($p = 0.03169$) – the higher it was, the more people rated this type

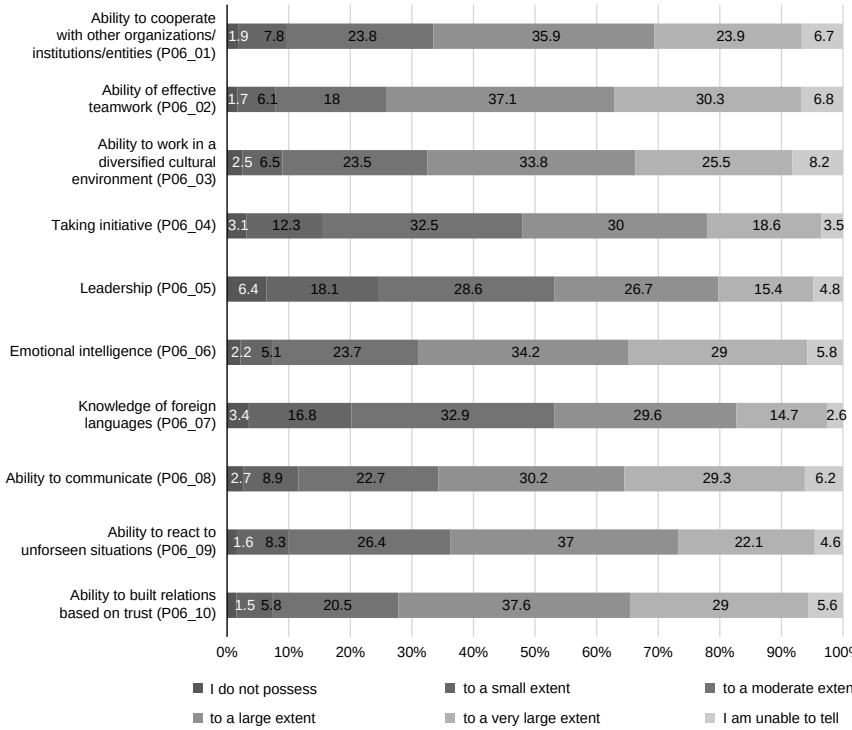

Figure 6.4 Self-assessment of the level of social competences (in %).

Source: own study.

of competence highly at home. However, in the case of assessing the level of emotional intelligence, the distribution of responses depended on the profile of education ($p = 0.00144$) – these competences were most possessed by people studying in the field of humanities. Just like the skills of effective teamwork, the ability to build relationships based on trust is necessary to function in the modern world, i.e. de facto respondents were asked to assess individual social capital in this case. 66.6% of respondents rated high or very high here, another 20.5% rated their skills as average. Interestingly, the distribution of answers did not depend on the field of study, the age of the respondents, or the level of education.

The lowest respondents rated their leadership skills and knowledge of foreign languages. These high or very high skills were possessed by 42.1% and 44.4% of respondents, respectively. In the case of leadership skills, the answers given depended only on age ($p = 0.02134$). People in the older age group rated their leadership skills higher than younger people.

The low assessment of foreign language skills is particularly worrying. REV4.0 and globalization are changing the work system and making the labor

market global. Hence, the lack of this competence may be the reason for the professional exclusion of a part of society. Only 44.3% of respondents rated this skill high or very high, and 32.9% believe that they have it at an average level. The distribution of answers to this question depended on the age of the respondents ($p = 0.0207$) and the level of education ($p = 0.00037$). People aged 18–24 and students rated their skills higher, and people with secondary education rated their skills therefore.

In order to examine the impact of the assessment of individual social skills on the overall assessment of their level, as in the case of digital competences, a model of linear discriminatory analysis was constructed.

Presented in Table 6.7, the overall assessment of the level of social competences was strongly related to the ability to: cooperate with other organizations, work effectively in a team and the ability to communicate (ease of establishing relationships), as well as emotional intelligence. Thus, it can be concluded that four out of ten skills studied significantly predicted a dependent variable (overall assessment of social competences). Hence, it should be stated that for the development and raising of their level, those skills that are a manifestation of individual social capital and allow for cooperation, building bonds and trust, and deepen interpersonal relationships are important. They are the determinants of effective work in a diverse environment and allow for flexibility and adaptability to changing conditions. The need to develop these competences arises for two main reasons. First of all, from the employee point of view, their improvement is necessary because it determines his/her attractiveness on the labor market and counteracts social exclusion. In turn, from the point of view of the organization, it allows you to build and maintain a competitive advantage in the global world (PARP 2020b). In this sense, these competences are crucial because they enable you to cope with the changes taking place and function in conditions of uncertainty and thus allow you to prepare cognitively for the changes that REV4.0 brings.

Table 6.7 LDA forecasting general self-assessment of social skills

N = 1000	*Wilks Lambda*	*Wilks particle*	*F-to-remove (5.985)*	*p*	*Toler.*	*1-Toler. (R-quad)*
P06_01	0.626949	0.987623	2.46883	0.031071	0.656962	0.343038
P06_02	0.631063	0.981184	3.77784	0.002150	0.682719	0.317281
P06_03	0.620254	0.998284	0.33862	0.889628	0.731578	0.268423
P06_04	0.624436	0.991597	1.66940	0.139237	0.530266	0.469735
P06_05	0.622489	0.994698	1.04998	0.386843	0.599405	0.400595
P06_06	0.633747	0.977030	4.63156	0.000349	0.806588	0.193412
P06_07	0.622029	0.995435	0.90341	0.478065	0.903693	0.096307
P06_08	0.665625	0.930237	14.77398	0.000000	0.624260	0.375740
P06_09	0.622855	0.994115	1.16620	0.323858	0.677899	0.322101
P06_10	0.622067	0.995374	0.91558	0.470012	0.715474	0.284526

Source: own study.

When it comes to the overall assessment of their social competences, 62.4% of respondents considered that they have them to a high or very high degree. In turn, 24.6% considered that they have them to an average degree. The distribution of responses was influenced by the field of study ($p = 0.01492$) and the level of education ($p = 0.03833$). Students and graduates of economic faculties rated the highest, slightly lower in the classification were students and graduates of humanities faculties. Taking into account the age cohorts, these competences were to a greater extent possessed by people from the 25–30 age group.

It is also worth noting that only 28.2% of respondents considered that the education system in Poland contributes to building and strengthening trust, social ties, pro-social attitudes, cooperation, including the development of intergenerational solidarity. However, 40.9% of respondents are of the opposite opinion. Making a detailed analysis of the answers given, it can be concluded that this assessment varies depending on the field of study and education ($p = 0.02474$) and on the age of the respondents ($p = 0.02341$). To the greatest extent, this dependence is noticed by people with strict education. However, when it comes to age cohorts, people aged 18–24 rated the education system to a greater extent as helpful in developing social capital. It should be noted, however, that taking into account the criterion of the direction of education and age of the respondents, respectively, 42.28% and 40.9% stated that the education system in Poland does not contribute to building and strengthening social capital.

6.4.4 Cognitive competences

Taking into account the changes resulting from REV4.0, from the point of view of young adults, it is necessary to develop cognitive competences within the framework of the so-called soft skills, which enable effective and constructive participation in social and professional life. Respondents rate these competences better than their social competences. As for their overall rating, 71.2% of respondents considered that they have them to a high or very high degree, and to an average degree 21.9%. In turn, 3.7% considered that they have them to a low degree or do not have them. The distribution of responses was influenced only by the level of education ($p = 0.02011$). The higher the respondent's education, the higher he rated his competences. The assessment of the level of individual cognitive competences is presented in Figure 6.5.

Among the cognitive competences surveyed, the most respondents indicated that they have a high or very high ability to think critically and filter information (71.5% of respondents), and the ability to reason logically (75.5%), as well as readiness for new technological challenges (70.9%). In the case of logical reasoning skills, the distribution of responses was influenced by the level of education ($p = 0.01365$). Having this competence was declared by the most people with higher education. However, when it comes to readiness for new challenges, the respondent answers depended on the field of study ($p =$

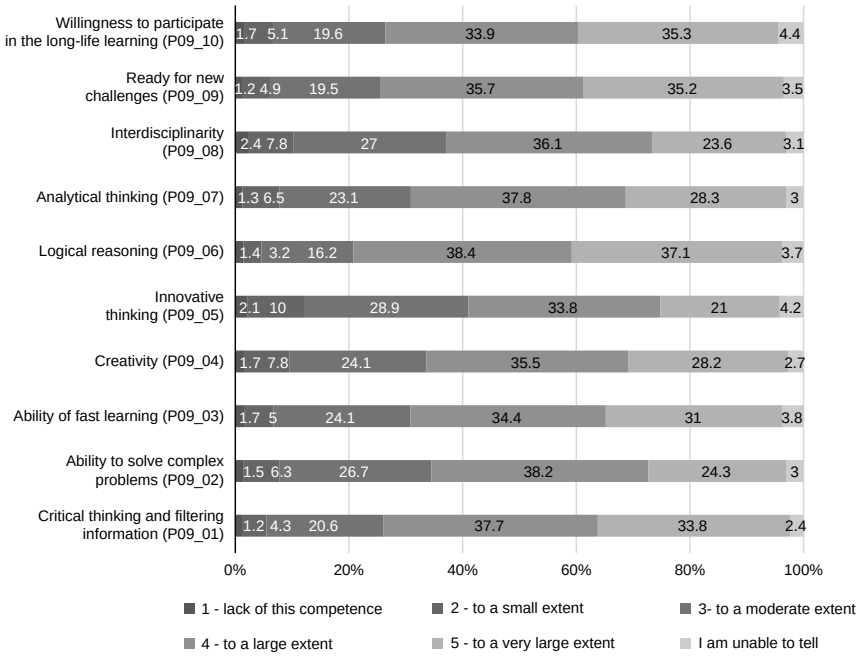

Figure 6.5 Assessment of the level of cognitive competence in the light of the results of surveys.

Source: own study.

0.04254) and the level of education (p = 0.01863). To the greatest extent, these competences were possessed by people with a science education, as well as people with higher education. At the same time, the respondents rated the ability to think innovatively, abstractly and transdisciplinary the lowest of these 11 competences. Only 54.8% of respondents declared having the first of these skills to a high or very high degree and as many as 12.1% did not declare it at all or declared its possession to a low degree. When it comes to interdisciplinarity, respectively, 59.7% declared possessing it, and 10.2% of respondents considered that they do not have this skill. It is also worth noting that the respondent answers in this case depended on the level of education (p = 0.01332), i.e. people with secondary education declared this skill at the lowest degree, and people with higher education at the highest degree. For other cognitive competences, research indicates that between 60% and 70% of young adults believe they have them to have them to a high or very high degree.

As in the case of social competences, in order to study the impact of the assessment of individual cognitive skills on the overall assessment of their level, a model of linear discriminatory analysis was constructed.

As can be seen from Table 6.8, the following skills proved to be important for self-assessment of the general level of cognitive competence: critical thinking and information filtering; solving complex problems; rapid learning; as well as analytical thinking; interdisciplinarity; creativity, readiness to participate in the LLL process and adaptability to changing conditions. Thus, it can be concluded that 8 of the 11 skills studied, significantly predicted a dependent variable (overall assessment of cognitive competence). The development of these cognitive skills is necessary so that individuals and society can actively function in an ever-changing world. "Particularly important is the ability to think critically, which today is one of the most valued and sought-after competences. It is a kind of realistic thinking, focused on a specific goal, which is evaluation. (…) The goal of critical thinking is a reliable and realistic assessment of the essential aspects of human intellectual activity" (Nęcka et al. 2006, p. 641). According to the informal code of the critically thinking person, she should (Cottrell 2005):

1 Skillfully evaluate opposing arguments and evidence,
2 Identify positions, conclusions and arguments, as well as techniques and manipulations that can be used to make your argument more convincing,
3 Consider problems in a structured, insightful and logical way,
4 Be able to present their point of view in a clear, understandable and thoughtful way.

Critical thinking competence, as well as the other soft skills mentioned, are qualities that can be acquired in the LLL process. They testify to the advantage of man over machines, which are beginning to displace human work. Although robots are slowly taking over many jobs, in creativity or communication skills they will still be able to match a human for a long time, and

Table 6.8 LDA providing for an overall assessment of cognitive competence based on the assessment of partial cognitive skills

N = 1000	*Lambda*	*Particle.*	*F-to-remove*	*p*	*Toler.*	*1-Toler.*
P09_01	0.513405	0.987289	2.533699	0.027356	0.708691	0.291309
P09_02	0.518504	0.977579	4.513615	0.000450	0.652096	0.347904
P09_03	0.515618	0.983051	3.392982	0.004801	0.717552	0.282449
P09_04	0.520049	0.974675	5.113544	0.000123	0.695128	0.304872
P09_05	0.510533	0.992843	1.418743	0.214829	0.682417	0.317583
P09_06	0.511484	0.990996	1.788080	0.112561	0.613738	0.386262
P09_07	0.515782	0.982739	3.456654	0.004207	0.681761	0.318239
P09_08	0.515141	0.983960	3.208091	0.007031	0.696553	0.303447
P09_09	0.508152	0.997494	0.494381	0.780621	0.660668	0.339333
P09_10	0.518249	0.978061	4.414424	0.000556	0.676057	0.323943
P09_11	0.514089	0.985974	2.799528	0.016125	0.660773	0.339227

Source: own study.

maybe never even a human. Robots, devoid of the emotional sphere, perform only the tasks assigned to them, and only a man with hard and soft competences depends on how they will be used. These competences make it possible to predict events that go beyond experience and are needed to create new knowledge and use the knowledge of others, recognize phenomena and events. Thus they provide cognitive flexibility in relation to new ideas and ways of acting. Thanks to the improvement of these competences, it is possible not only to adapt to changes resulting m.in technological progress, but also to understand the phenomena occurring in the surrounding world.

6.5 Digitization of the education process – new challenges

The processes of digitization are changing the conditions of the functioning of society, and modern technologies are ubiquitous. Their importance has already been highlighted by K. Schwab (2016), emphasizing the impact of technology on human life (see also Chapter 1). The particular importance of digital technologies is visible in the area of education. This is due to the fact that they are used both for the implementation of the educational process and are the content of this process, the purpose of which is to provide opportunities for the development of digital competences. Therefore, the socio-economic changes taking place force a redefinition of educational policy, not only in relation to the way of conducting educational classes and the use of IT tools, but also in terms of changes in the content of the curriculum. In particular, these changes should be focused on the development and deepening of digital skills, but as indicated above, also others necessary to adapt to the changing reality.

The results of research conducted before the Covid-19 pandemic indicate that the use of technology was mainly limited to activities outside of school and spending free time (OECD 2019b). Digital education at school is one of the most important challenges for the education system both from the point of view of the labor market and from the social point of view. In the first case, there is a gap in the skills area that needs to be filled. This is due to the fact that more and more professions require proficiency in the use of information technology, and many jobs rely on specialized digital skills (Cedefop 2018). From a societal point of view, the challenge is to socially include digitally excluded people in order to counteract the widening gap between those with very low digital skills and those with higher levels of digital skills (European Commission 2019b).

Research to date on the use of digital technologies in teaching does not provide conclusive answers about the effects of using these technologies (Bulman and Fairlie 2016; Escueta et al. 2017). On the other hand, the results of the research by Blossfeld (2018) and Süss, Lampert and Wijnen (2013) point out that technologies can increase student motivation, support the individualization of the learning process and, finally, contribute to the creation of innovative learning environments.

Technology may be a short-term tool for improving learning during a course, but it is increasingly being used as a basic tool in the education process over a longer time horizon. However, in the latter case, attention is drawn to the negative effects of excessive use of information technology in the form of deterioration in the quality of learning. The positive effect, in turn, is particularly evident in the case of children (Lou et al. 2001) or people from difficult backgrounds (Sandy-Hanson 2006; Sisson and Katzmarzyk 2008; Li and Ma 2010). Technology cannot replace humans (Liao 1998; Ahmad and Lily 1994; Bayraktar 2001; Sisson and Katzmarzyk 2008; Cheung and Slavin 2011), but it can be a very effective tool especially in science teaching, although many studies suggest that it has the greatest effects in the field of learning to write (Goldberg et al. 2003; Morphy and Graham 2012). Research also suggests that experienced educators are only able to teach effectively in an e-learning system if the learners are highly motivated and experienced (able to learn) (Kanuka 2008; Passey and Higgins 2011). Modern technologies can both short- and long-term increase interest in classes, but in the case of their permanent use, it is important to properly prepare the subjects of the educational process. In addition, taking into account the threats resulting from cybercrime or addictions, the implementation of technology into the educational process must also involve teaching the principles of effective and safe use of them.

The scope and effects of the use of digital technologies in the education process depend on many factors, both personal (students, teachers and the level of their motivation and predispositions) and systemic (organizational, i.e. digital resources and their availability). In various countries, the implementation of modern technologies into the educational process is at different levels. For some countries, this is a stage of building digital infrastructure, while in others more advanced in this process emphasis is placed on the development of digital competences of participants in the education system. According to Conrads et al. (2017), the development and improvement of infrastructure alone does not lead to the systematic integration and use of digital technologies in teaching. That is why it is so important to properly prepare the subjects of the educational process for their use.

Referring to the considerations on digital competences in the previous section, it should be noted that a coherent approach to defining digital competences as key competences can be observed across Europe. In almost half of education systems, these definitions refer to a European key competence in digital competences. In Germany, Croatia, the Netherlands, Portugal, Slovakia, Sweden, the United Kingdom (Wales and Scotland) and Norway, only the national definition of digital competences is used, and in Estonia, France, Cyprus, Lithuania, Malta and Austria, both the European and national definitions (European Commission/EACEA/Eurydice 2019a).

The development of student digital competences is part of virtually all primary and secondary school curricula in most education systems of European countries. However, it is implemented in various ways:

- As a cross-subject issue implemented within all subjects,
- As a separate subject,
- As an issue integrated with other subjects.

On the other hand, in half of the education systems, digital competences are not assessed in schools as part of national examinations. Only in Austria and Norway are digital examinations carried out at all levels of school education. In Latvia, digital competence examinations are conducted only in lower secondary education, in the Czech Republic, Denmark, Estonia, Greece, France, Croatia, Cyprus, Malta, Austria and Norway, they are conducted in both lower and lower secondary education, while in Bulgaria, Lithuania, Hungary, Poland, Romania, Slovenia and the United Kingdom only in lower secondary education. The results of research conducted in Poland, presented in the previous subsection, indicate that despite the existence of awareness of the importance of these competences in the modern world and the inclusion of information and communication technologies in curricula, they are at a low level (European Commission/EACEA/Eurydice 2019a).

Both formal and informal education systems should use innovative technologies. Therefore, participants in education must have access to up-to-date technologies and technical knowledge. In the process of implementing educational classes, especially in the era of the pandemic, it has become very common to use various types of software and tools enabling remote education. In April 2020, remote education covered nearly 1.6 billion, or 91.3% of pupils and students in 188 countries (PARP 2020b). The closure of schools and educational institutions undoubtedly had negative consequences for all entities of the educational process, e.g. due to the exclusion of some students from the education system. On the other hand, remote learning with the use of various types of IT tools was often the only possibility to carry out educational activities in connection with the pandemic (for example, in Italy, France and Germany, learning took place fully online). It is also worth noting that while in the case of higher education, online classes were carried out to some extent even before the Covid-19 pandemic, in primary and secondary education they were used very rarely. The scope of use of ICT in the process of education and the functioning of educational platforms and online courses is discussed in more detail in the third chapter. Moreover, the problem was the lack of ability to use digital technologies in a critical, creative and informative way (European Commission 2019b). According to the International Computer and Information Literacy Study (ICILS), many of the ICT technologies are never actually used by students. For example, between 75% (ISCED 2 – secondary education, lower level, or the second stage of primary education) and 79% (ISCED 3 – secondary education, higher level) of pupils have never used data logging tools at school. In addition, between 71 % (ISCED 2) and 73 % (ISCED 3) have never or almost never used image editing tools (Figures 6.6 and 6.7).

The goal of ICILS conducted in 2018 was to measure student skills in using computers to collect data and manage information and create and exchange

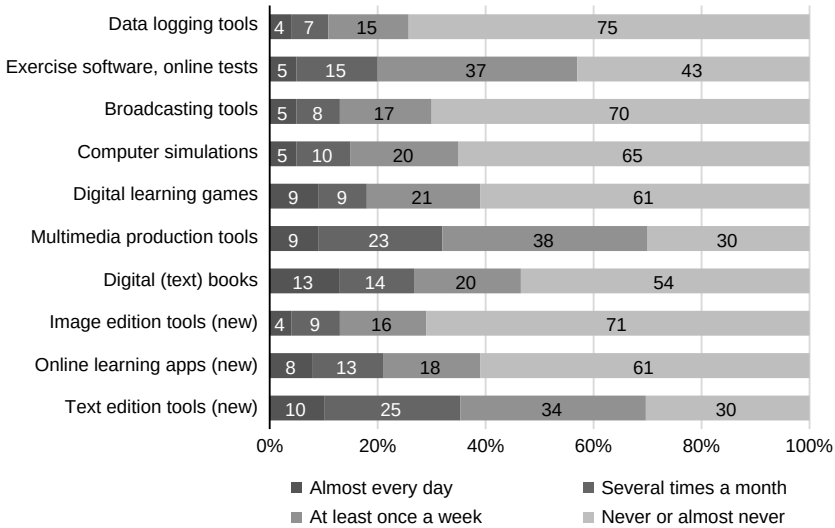

Figure 6.6 Students' use of digital resources and tools (ISCED 2, in % of students, EU level, 2017–18).

Source: European Commission (2019c).

information (CIL), as well as solve problems using a computer (CT). The results of the survey show that the level of digital competence varies widely across the seven EU countries surveyed. The average score in this group was 496 points. In five countries it was above the average (e.g. Denmark, Finland and Germany), and in two it was significantly lower (Luxembourg, Italy). Similar differences in CIL score in the EU were observed in a previous study in 2013, and Poland participated in this study, where the CIL score was above the average for the study group. Surveys conducted in 2013 and 2018 show that students in most countries (19 out of 26 respondents) achieved results that placed these countries at the lower end of the LEVEL 2 range of the CIL scale (492 to 576 points). The digital competence scale measured by the CIL instrument in ICILS is based on four levels of enhanced proficiency: level 1 (407 to 491 points), level 2 (492 to 576 points), level 3 (577 to 661 points) and level 4 (above 661 points). Achieving scores on the second level of the scale means that students have basic skills in using computers as a source of information and are able to collect basic and indicated information and perform specific tasks. It should also be emphasized that the achieved results were statistically significantly influenced by socio-economic factors such as professional status of parents, level of education of parents (European Commission 2019c). Undoubtedly, the level of student digital competences was influenced by the change in the way classes are conducted due to the Covid-19 pandemic,

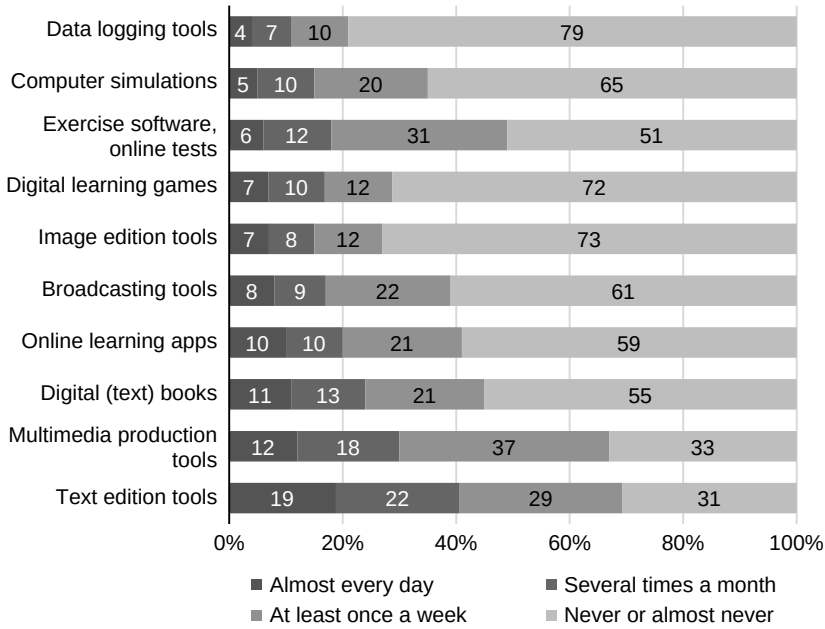

Figure 6.7 Use of resources and tools during lessons (ISCED 3, in % of students, EU level, 2017–18).

Source: European Commission (2019c).

which meant the need to use various types of IT programs and tools on an unprecedented scale.

In the era of the Covid-19 pandemic, among the methods and tools used in the education process, online distance learning platforms were of particular importance (they are discussed in more detail in Chapter 3). They contain both entire online courses and various digital resources supporting teaching (e.g. video files, quizzes, presentations), and also allow you to conduct classes in a synchronous way. What's more, the transfer of education to the Internet also resulted in the development of new educational platforms, enabling international cooperation aimed at making existing online educational resources available to each other (PARP 2020b). IT tools were based on the possibilities resulting from access to the Internet and (public) television. In this context, it should be stressed that education in the Covid-19 pandemic would not have been possible without universal access to the Internet and ICT, the importance of which in providing the conditions necessary to promote a modern and competitive economy was recognized much earlier. Already in 2007, 53% of households in the EU-27 had access to the Internet, and this percentage has been steadily increasing. In 2012, it amounted to 75%, and in 2019 it increased

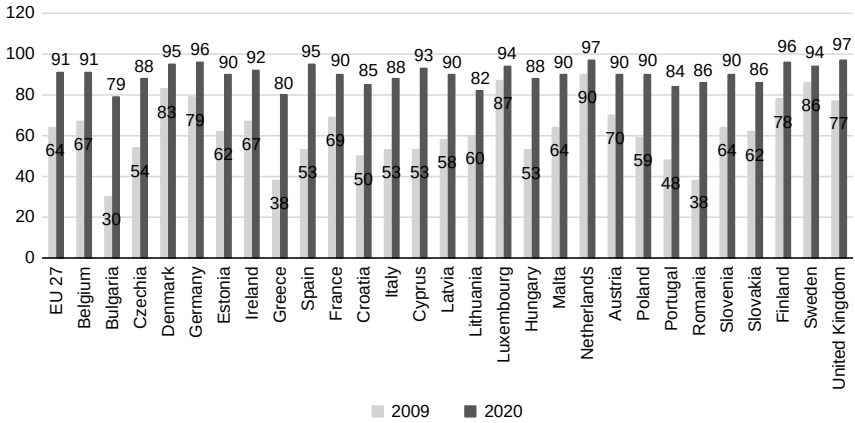

Figure 6.8 Households level of internet access in European Union (in %).

Source: Eurostat 2021a.

to 90%. This means that it has increased by around 37 percentage points since 2007 (Figure 6.8).

The highest percentage (98%) of households with internet access in 2019 was recorded in the Netherlands. In countries such as Sweden, Germany, Denmark, Luxembourg, Finland, Ireland and Spain, more than 9 out of 10 households had access to the Internet. The lowest rate among the EU-27 was recorded in Bulgaria (75%). It should be emphasized, however, that this country (as well as Romania, Portugal, Spain or Lithuania) recorded one of the largest increases in the Internet access rate. Between 2009 and 2019, this increase was 22–48 percentage points.

Individual Member States have used different ICT tools and technologies in the education process during the pandemic. In Finland, for example, the most commonly used tools for students to learn and attend online classes were Moodle, Google Classrooms, Ville, Teams, Office 365, Skype and Zoom. The main platforms used in primary and secondary education are Helmi, Wilma (Primus), Studentaplus and Sopimuspro. Spain, on the other hand, used multichannel sharing of educational resources m.in via public television and online (on demand). In the Czech Republic, the website Distance Education has been launched, which supports schools and teachers in conducting remote education. It contains both links to online educational tools and updated information and examples of good practice (PARP 2020b).

Taking into account the need to use ICT on a massive scale due to the Covid-19 pandemic, as part of the research conducted in Poland, respondents were asked about their knowledge and the scope of using computer tools and programs in various areas (Table 6.9).

Table 6.9 Knowledge and scope of use of computer tools and programs in Poland (in %)

Nr.	*Tools and programs*	*1 – I do not know and do not use*	*2 – I do not know. but I heard*	*3 – I know but I do not use*	*4 – I know and use sporadically*	*5 – I know and use often*
P08_01	Tools for webinars and online group meetings	6.9	13.7	25.8	28.4	25.2
P08_02	Online Learning Platforms	8	14.9	26.8	30.3	20
P08_03	Tools for separating and planning group work	22.7	23.5	28.7	17.4	7.7
P08_04	File sharing platforms	13.5	20.9	29.7	24.6	11.3
P08_05	Security Programs	5.5	16.3	30.3	32.7	15.2
P08_06	Text editors and other general-purpose programs	3	7	21	39.2	29.8

Source: own study.

To the greatest extent, respondents know and use text editors and general-purpose programs. However, only 69% of respondents are familiar with these tools and use them sporadically or frequently. The distribution of responses depended on the age of the respondents ($p = 0.000001$) and the level of education ($p = 0.000001$), as well as on the education profile ($p = 0.01679$). In the first case, young people (18–24 years old) rated themselves much higher. However, taking into account the level of education, the knowledge and use of these tools was declared to the greatest extent by students, not people with higher education. As for the profile of education, these tools were used to the greatest extent by people with humanistic education. Another frequently used tool was programs for webinars and online group meetings. 53.6% of respondents indicated that they use them sporadically or frequently. On the other hand, as many as 20.6% of respondents said that they do not know these tools and do not use them. The distribution of responses depended, as in the previous case, on age ($p = 0.000001$) and level of education ($p = 0.000001$). These tools are best known and used by people in the group of 18–24 years old and students. The respondent assessment was particularly low in terms of their knowledge of tools for separating and planning group work and platforms for file sharing. Only 25.1% use these tools sporadically or often, and 35.9% use file-sharing platforms. In the latter case, the distribution of responses depended on the education profile ($p = 0.01136$) and age ($p = 0.00044$). To the

greatest extent, these platforms were used by people with science education and younger people (18–24 years old). Of particular concern is the fact that only less than half of the respondents (47.9%) use programs that ensure the safety of using information and communication technologies. Their importance is emphasized in various EU documents (e.g. DigComp), and the need to use it results from, inter alia, the growing number of cyberattacks, targeting both public institutions and companies, but increasingly also individual users. Failure to ensure an adequate level of security when using digital tools can cause irreparable damage. They can be both material (loss of computer equipment) and financial and personal (violation of personal rights). For example, American AT&T points to a 458% increase in attempts to scan Internet of Things systems for their vulnerabilities (AT&T 2016). Hence, it became necessary to take a more proactive approach. From the point of view of European countries, the cybersecurity package is of particular importance and its Cybersecurity Act is the second pan-European cybersecurity regulation after the NIS Directive, which imposed a number of obligations on the Member States, obliges them to set up specific institutions and introduce cooperation mechanisms. The second regulation entered into force on 27 June 2019 and creates a European cybersecurity certification framework for ICT products and services.

6.6 Pillars of the redefinition of education policy in the era of Revolution 4.0 – toward social inclusion

The ongoing socio-economic changes resulting in REV4.0 and the ageing process of the population mean not only the need to develop new competences, but also involve a change in the way educational services are provided and financed. In the first case, it is primarily about the increase in the importance of social, cognitive and digital competences, the development of which is not limited only to participation in formal education, but requires participation in lifelong learning. As a consequence of demographic changes, an increasing percentage of the population, regardless of their will, will be forced to constantly define their identity and build their social position without resorting to traditional social roles (Beck and Beck-Gernsheim, 2002). Hence, the aging of the population, resulting in a decrease in the number of pupils at all stages of education, as well as an increasing percentage of people of post-working age, is one of the most important challenges facing the education systems of EU countries. It seems, therefore, that intensifying efforts to open up the education system to adults will determine its functioning in the coming years. In this sense, the key role, due to the increase in labor productivity, as well as the improvement of the quality of life of seniors and the achievement of life satisfaction, has lifelong education and the dissemination of the concept of lifelong learning. This is one of the biggest challenges in the area of education, especially since in many EU countries the indicators for participation in LLL are at a very low level (Figure 6.8). According to Delors (1998), in

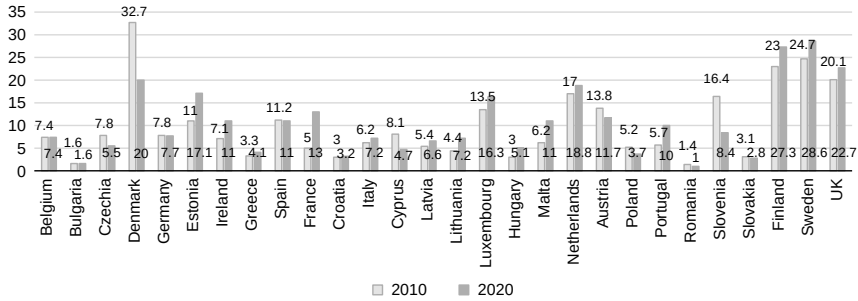

Figure 6.9 Participation rates in lifelong learning in EU countries (in %).

Source: Eurostat 2021b.

response to the challenges of the changing world, in the face of the ongoing process of globalization, threats, civilizational changes and the transformation of societies, education was given an important role in the 21st century, and adult education was called the phenomenon of the second half of the 20th century. This education should include all forms of knowledge, skills and attitudes that can contribute to prosperity and improve the quality of life (Dzięgielowska 2006). Lifelong learning involves intellectual development, as well as the development of social characteristics in all forms and contexts, so that learning does not end with graduation, but continues until the moment when a person demonstrates the need for his own development (Suchy 2010). Hence, it is necessary to agree with the statement that the main purpose of education is not only the transfer of knowledge or the formation of skills, but above all to help individuals realize their own capabilities and self-development (Lowe 1982) (Figure 6.9).

The countries where the most people aged 25–64 participate in lifelong learning are the Scandinavian countries, Luxembourg, the Netherlands and the United Kingdom. In contrast, in the countries of the former Eastern Bloc, the participation rate in LLL is at the lowest level. A comparison of the 2010 and 2020 benchmarks shows that it has remained unchanged or increased in most countries. However, its decrease was recorded in several countries, e.g. Denmark, Cyprus, Poland, and Romania. The tree diagram of participation rate in education and training for people in the group age 25–64 in 2020 is presented in the Figure 6.10.

The analysis of the tree diagram allows for dividing the countries into three groups: Finland and Sweden, United Kingdom, Estonia, Denmark Netherlands and Luxembourg are clearly different from other countries. In these countries, the percentage of people who participate in education and training is the largest. A separate group was also formed by: Belgium, Italy, Germany, Latvia, Lithuania, Portugal, Slovenia, Ireland, Malta, Spain, Austria and France, where the examined rate of participation in education and training are generally at an

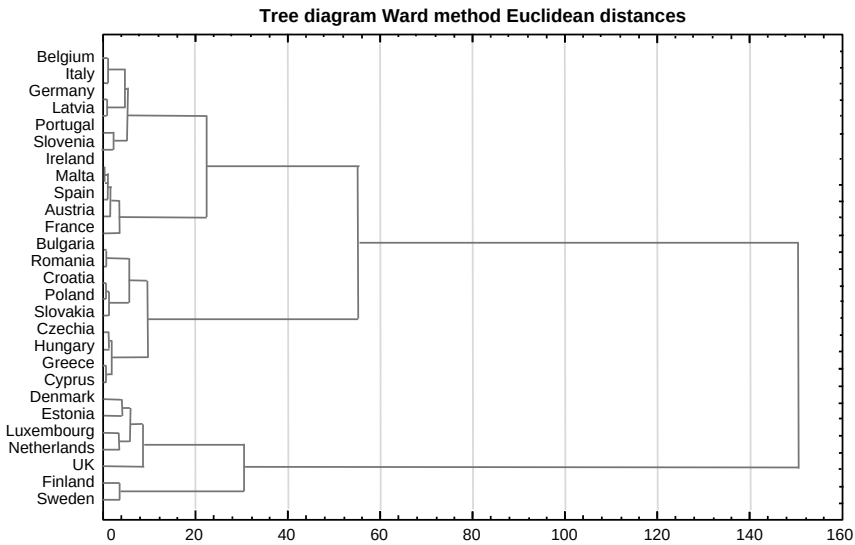

Figure 6.10 Tree diagram for participation rate in education and training in age group 25-64 in 2020.

Source: own elaboration based on Eurostat 2021.

average level compared to the countries forming the other two groups. The third group consists of countries with the lowest level of the examined indicator. These are the mainly countries that joined the EU after 2003 (Slovakia, Greece, Poland, Czechia, Hungary, Cyprus, Romania Bulgaria, and Croatia).

The low level of the analyzed indicator is worrying, but on the other hand, in the light of research conducted in Poland, it can be concluded that young adults (18–30 years old) who are still in the process of education or have just completed it unequivocally declare their willingness to develop their personal and improve their social, cognitive and digital competences in the LLL process. Willingness to develop social competences – declared 74% of respondents, digital competences – 75% and cognitive – 77% (Table 6.10).

The distribution of responses regarding the development of social competences in the LLL process was influenced by both the education profile ($p = 0.03349$) and the age of respondents ($p = 0.01796$), as well as the level of education ($p = 0.00004$). To the greatest extent, the desire to improve social competences was declared by students and graduates of economic faculties, a younger cohort, and, as in previous cases, people with higher education. In the case of the desire to develop digital competences, the level of education ($p = 0.00052$) had an impact on the distribution of responses. Finally, in the case of answers concerning cognitive competences, their distribution was influenced by the education profile ($p = 0.02226$) and the level of education ($p =$

Table 6.10 Competence development in the lifelong learning process (w%)

	Competence	*1 – I'm not going to*	*2 – I'm not going to*	*3 – hard to say*	*4 - rather I'm going to*	*5 - definitely going to*
P012_01	Social competence	1.7	4.5	20.5	37.1	36.2
P012_02	Digital competence	1.2	4.3	20	33.3	41.2
P012_03	Cognitive competence	0.9	3.3	19.1	39	37.7

Source: own study.

0.00003). These competences are planned to the greatest extent by students and graduates of economic faculties, as well as people with higher education.

Respondent responses in this area are reflected in their expectations of the goals of the education system in the era of REV4.0. They clearly indicated that the education system should enable the development of social, cognitive and digital competences. More than 70% of respondents considered that these competences should be transferred in the education process (Table 6.11). Interestingly, the highest percentage of "rather yes" or "definitely yes" answers concerned cognitive competences, only in second place (77%) were digital competences, and in third place were social competences (73%). In the case of digital and cognitive competences, the distribution of responses depended on the education profile ($p = 0.0025$, $p = 0.04108$) and the level of education ($p = 0.0019$, $p = 0.00494$). The need to develop digital and cognitive competences was indicated primarily by students or graduates of economics and people with higher education.

The results of research in the field of competence development outside formal education indicate that although the respondents are interested in raising competences via the LLL process, this need is declared to a much

Table 6.11 Competences that should be transferred in the education process in the era of REV4.0 in the light of surveys

Class	*Competence*	*1 – definitely not*	*2 – probably not*	*3 – hard to say*	*4 - rather yes*	*5 - definitely yes*
P011_01	Social competence	1.4	3.4	21.4	34.9	38.9
P011_02	Digital competence	1.2	4.1	17.3	33.3	44.1
P011_03	Cognitive competence	1	2.6	18.4	39.7	38.3

Source: own study.

greater extent by people with higher education. Low socio-economic status is associated with a lower awareness of the effects of technological progress and a lower level of competence needed in the era of REV4.0. This creates the risk of widening the digital divide, so it seems that the challenge of those influencing the shaping of education policy within the framework of social inclusion should be to intensify efforts to activate people with a lower level of education.

The redefinition of education policy in the era of REV4.0 must therefore be based on three pillars. Firstly, activities aimed at integrating disadvantaged groups into the education system, especially non-formal through the LLL. This concerns both entities that will be the organizers of these activities (the state, local government units, employers, entities of the so-called third sector), as well as participants, i.e. people using various forms of improving competences (e.g. employees, unemployed people, students and pensioners). Changes in this area will prevent the widening of differences in the level of education, and thus the social and digital exclusion of people of working and post-working age. Moreover, they will provide greater opportunities for adaptation to the changing conditions of functioning and evolution of the labor market. In order to be able to open education to new actors and social inclusion, it is necessary to increase access to the education system by basing it on new information and communication technologies, which are the second pillar of the modern education system. Both of these pillars are interconnected. The achievements of technological progress cannot be effectively used in education if the participants of the system are not equipped with appropriate competences, especially digital ones, the acquisition of which is associated with m.in participation in the LLL process. At the same time, digital competences are important from the point of view of the third pillar of the redefinition of education policy, because the element connecting the third pillar with activities in the area of the second pillar is digitization, which affects the way of life, work, interpersonal contacts, becoming a key element of the functioning of individuals and society. However, in order to ensure the inclusive development of society in the era of REV4.0, it is necessary to harmoniously develop the key digital, social and cognitive competences needed to function in an ever-changing socio-economic environment. Their development is necessary to counteract the deepening of disparities in the level of education, processes of social exclusion, but also to eliminate competence gaps.

Experts on the future of the labor market predict that new sectors of the digital economy will need m.in analysts, architects and people who can acquire key data, software and application developers, AI specialists, designers and manufacturers of new intelligent machines and robots, as well as digital marketing and e-commerce specialists. Hence, digital competences are fundamental because they significantly affect the efficiency of the economy, enterprises, the level of employment and innovative capabilities. The fact that current generations are witnessing REV4.0 does not mean that they are digitally competent. Contrary to popular belief, especially among young adults,

that they are proficient in new technologies, the results of the study indicate that growing up in a digital environment does not mean the development of advanced digital skills. Hence, a holistic approach to the transfer of digital competences is necessary. To develop digital skills, it is not enough to provide an adequate IT infrastructure. Care should also be taken to develop these competences in such a way as to reap the benefits that technology can bring to the teaching and learning process and to guarantee its safe use. Therefore, people who enter the labor market will have to have cognitive and social skills in addition to digital competences.

To sum up, it should be stated that the challenges and potential benefits of developing key competences are visible in two areas: economic and social. From the perspective of the labor market, there are gaps in the skills of employees due to the increasing use of modern technologies resulting from digitization, globalization processes, climate change, an aging population, new business models and cultural changes, as well as the development of the concept of the sharing economy. From a social point of view, the challenge is the inclusivity of the education system, which is possible only by basing education on a kind of triangle of harmonious development of key competences (Figure 6.11). This development includes all types of competences that are complementary to each other, and their development enables comprehensive human development.

In the light of the above considerations and the results of the research carried out, it should be agreed with the statement that the goal of the education and training system in the era of REV4.0 should be the creation of a broadly educated person, capable of critical thinking, thinking in innovative and alternative terms, showing initiative, sensitive and aware of values (Hausner 2020). According to Hausner (ibid. p.5) "in the transformation toward the unknown, the answer to technological changes and the related processes of atomization of social life cannot be further technicalization of social roles and the education that follows it, but precisely to address the challenges of continuous technological progress in a way integrated with certain fundamental values/questions important for the subjective existence of man and society." Hence, integrity becomes a necessary condition for maintaining a balance between the beneficial and negative manifestations of technological progress. Therefore, it is necessary to change the education system and move from the transmission model consisting of transferring knowledge and reproducing it, to the relational model of stimulating and developing reflective and creative thinking, based on imagination (Czapliński et al. 2021). This will allow for active shaping of reality and taking pre-emptive actions, enabling society to systematically adapt to the changing environment.

6.7 Chapter summary

Digital transformation, as well as ecological transformation, is changing the socio-economic environment and conditions for the functioning of the state, society and citizens in the 21st century. The use of modern technologies

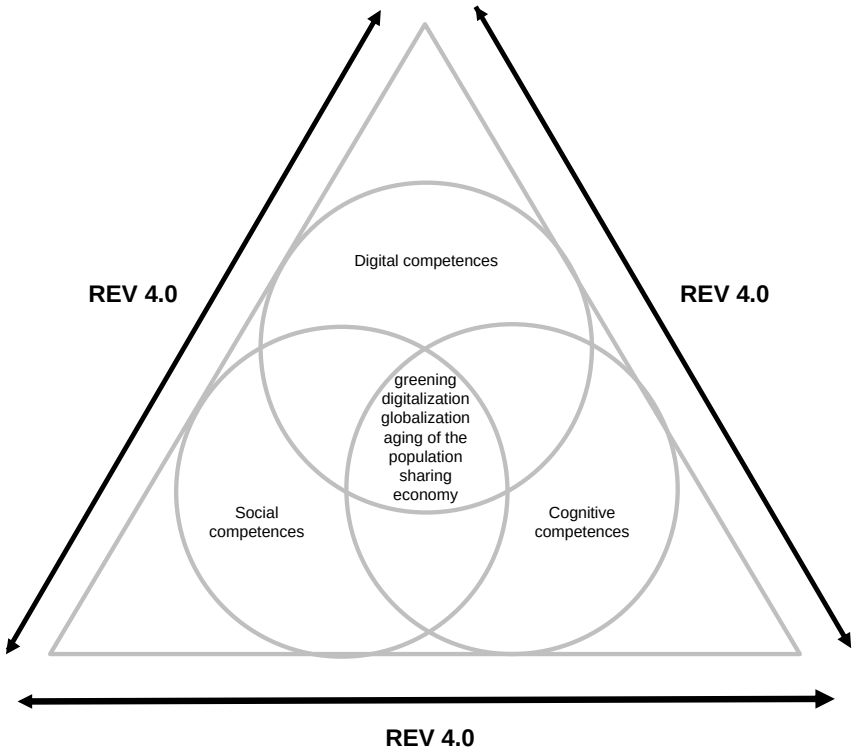

Figure 6.11 The triangle of harmonious development of key competences in the era of REV4.0.

Source: own study.

(blockchain, artificial intelligence, robotics, machine learning, and the Internet of Things) leads to changes in the labor market, as new profession appear and others vanish. The progressive aging of the population, in turn, means that each subsequent generation of post-working age people will be smaller, making it necessary to increase the efficiency of work. Future labor resources in Europe will be recruited from a significantly older population than the present one. This trend calls for the improvement of training systems, especially of adults, who will form a significant pool of candidates for recruitment, while the effects of their employment will determine further socio-economic development. These changes indicate the need for unprecedented development of new skills in order to fully use the potential of available employees. The need to develop skills, especially digital skills, was made even more visible by the Covid-19 pandemic, which accelerated the digital transformation and allowed for the identification of employee competency gaps. Hence, the concept of lifelong learning comes to the forefront of education policy in the

European Union as it enables the constant development of professional skills and competences throughout one's life. While learning at an early age continues to be essential, lifelong learning for those leaving formal education will also be vital. Only this approach to education will enable harmonious development, including supporting sustainable competitiveness, ensuring social justice and building resilience understood as ensuring an adequate number of employees in strategic sectors of the economy. All EU citizens should have access to attractive, innovative and inclusive learning programs. This requires the adoption of a new paradigm in terms of skills and competences, hence the pillar of education policy should be a skills and employment program that stimulates the process of change resulting from megatrends occurring in various spheres, in particular digitization, environmentalism and globalization.

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