

New Competences and Skills - Changing the Education Program in Response to Technological Challenges (Empirical Research)

**Izabela Czaja, PhD,
Malgorzata Kosala, PhD**

Cracow University of Economics, ORCID: 0000-0002-2243-848X, Cracow University of Economics, ORCID: 0000-0003-2445-873X, czajai@uek.krakow.pl, kosalam@uek.krakow.pl

Abstract

The labor market is a place where labor services are provided to people who need and use these services. Work, and more specifically labor-related services, is one of the three classical factors of production, alongside capital and land. When the supply and demand for labor are equal, we can speak of a market equilibrium. It is worth mentioning that the general equilibrium consists of partial equilibria of the labor market, which in turn are shaped in the markets of industrial, agricultural, service, commercial, etc. production. Technologies changing the structure of the labor market and introduced to the market constitute an important factor supporting economic development. One of these technologies is computerization, which enables digitization (digital recording, change or conversion from physical to digital form) and then digitization, i.e. the use and application of processed data in a household, enterprise or country. The term Industrie 4.0 comes from the project of the German government's high-tech strategy promoting the computerization of production processes and was first used at the Hanover fair in 2011. Since then, there has been an increased interest in changes caused by digitization and their impact on the labor market. The article contains the results of research (delphi method) and CATI on the digital skills of future employees of Polish enterprises, which should be educated throughout the education process in Poland. What is needed is the humanization of cobotization - cooperation with robots and IT. Creativity comes first among the skills needed in the future, followed by cause and effect thinking, commitment and digital skills. In the case of education, it is obvious to combine learning with practice. In the case of education, there is a clear indication of exact sciences (technical, IT). The importance of non-formal education is growing.

Index terms: industrial revolution, labor market, competencies, education, digital skills.

I. Introduction

The noticeable progress in the development of digital technologies changes the economic conditions for the functioning of enterprises. Already now, digital technologies allow for relatively easy and quick access to information, the provision of services without the need to move and the performance of work or professional duties on a global scale, affecting the dynamics of the achieved economic benefits. These changes translate into the labor market. According to forecasts, in the coming years the processes resulting from the development of digital technologies, including those related to robotization, automation and the use of artificial intelligence, will have the greatest impact on the labor market. Therefore, it becomes an important issue to adapt the professional competences of employees to changes caused by technological progress. This area is created by the labor market and educational institutions. This article will address the issue of expected changes in the sphere of education, which will include both jobs with high and low demand in the future, as well as jobs that currently do not exist on the market but are expected by enterprises and market forecasters.

II. Literature review and identification of areas requiring in-depth research on the labor market

A review of the literature, analysis of reports and statistical data resulted in undertaking empirical research in order to determine the expected structural economic changes, the nature of the demand for the labor factor (workforce), e.g. searching employees for skills in the field of digitization. An important element of forecasts and development scenarios is the new role, functions and importance of universities as institutions of higher education (HEI) in the future (Clark 2004, Czaja Urbaniec 2019, Czaja, Kafel 2021, 2022). One of the many hints in the process of transforming the target education system is provided by the studies of the European Commission, which draw attention to the need to shape entrepreneurial (McCallum, Weicht., McMullan, Price 2018) and digital (Vuorikari, Punie, Gomez, Van Den Brande 2016) competences as those inclusive from the point of view of the

labor market. The industrial revolution 4.0, digitization and digitization of industry related to the fourth revolution is based on nine advanced technologies that play a key role here. As a result of transformation, sensors, machines, details and IT systems are combined into a value chain (Kosała, Jelonek Gorzelany-Dziadkowiec 2022). Currently, the work environment of people, automatons, robots and artificial intelligence is connected, but it is human work that is giving way to modern technologies. According to Oxford University analysts (Frey & Osborne, 2017), automation, robotization, digitization and digitization will make almost half of the jobs on the market disappear within the next quarter century (47%), while in Poland slightly less, but still almost 40% work is at risk of automation (OECD, 2018b). The professions threatened by automation are a telephone salesman (99%), a bank or post office employee (97%) or an insurance agent (97%). In contrast, the lowest risk of automation concerns therapists and psychologists (0.7%), nurses (0.9%), IT business analysts, data architects and system designers (1%), clergy (1.6%), doctors (2%) and lecturers (3.2%). On the other hand, professions that require empathy, closeness or agility and flexibility, e.g. during rescue operations, are classified as irreplaceable jobs (Frey and Osborne, 2013, 2017). Moreover, the occupations most prone to automation are not only those related to production, logistics and transportation, but also all those that require low to medium skills to perform routine, repetitive activities. Automation and digitization of a large part of the professions related to data processing and handling, mainly financial, tax and document archiving are expected (Schwab 2016, Frey Osborne 2017, Kosała 2020). Although the benefits achieved thanks to digitization are noticeable, undoubtedly, in combination with the intense pace of changes, they may affect the imbalance in the socio-economic system. Each deep breakthrough, deep economic, technological, political or systemic transformation increases the risk of destruction in the system of social values, increases the risk of anomie, i.e. the absence of law. The anomaly affects almost all forms of social life, including economic life. It is precisely the problems caused by the rapid dissemination of digital technologies and the maladjustment of other systems of the entire socio-economic system that can and presently constitute significant challenges for the participants of the labor market, both on the demand side (employers) and the supply side (employees). Employers who use technological advances and technical progress, modernize production lines, communication, delivery and payment systems, but often reduce the number of employees (Duda Bernat, 2022). , the need to adapt to the new requirements of employers and concerns about the sources of income and their size, ensuring the maintenance of the current standard of living (Urbaniec 2022). Observations of the American market show the importance of the so-called gig economy, which consists in subletting to perform individual orders by subcontractors who are not employees of enterprises. According to data from a report by an organization associating American freelancers, currently performing various types of jobs on an occasional basis, "freelancers" constitute 34% of the workforce in the American market (Freelancing In America 2016). On the one hand, employers expect the possibility of recruiting employees with specific predispositions, allowing them to take jobs created in organizations and perform the tasks resulting from taking them in a satisfactory manner. with various forms and duration of employment (Urbaniec 2022). Maintaining this balance is a kind of security for a given socio-economic system (Kosała, 2020).

III. Methodology of research

The research methodology is based on two stages of qualitative and quantitative research. Due to the need to recognize the impact of the digital revolution on the labor market, the Delphi method, belonging to the analytical methods, was initially carried out in order to define the scope of the research area (Kaufmann, Fustier, & Drevet 1970, Dalkey 1968). The second quantitative method (CATI questionnaire) developed the topic in the field of digital competences and skills required in the labor market in connection with the technological revolution 4.0 and its impact on the industry and service sectors in the near future (Czaja, Urbaniec 2019, Kosała 2020). The concept phase of the Delphi method (Dalkey 1968, Denzin 2009) and the preparatory phase allowed for the preparation of a questionnaire relating to the labor market, employment, changes in the demand for work in particular industries, and an indication of what types of jobs and skills will be sought by employers. The Delphi method was developed in order to reduce the undesirable features of direct communication, maintaining the rigors of research: independence of expert opinions, anonymity of expressed judgments, multi-stage proceedings and the desire to agree and sum up the opinions of participants. Three questions were asked consecutively in two rounds, namely: What new professions and areas of economic activity may emerge as a result of the growing importance of solutions based on artificial intelligence? Which skills and competences of employees will be important in the perspective of 5-10 years, taking into account changes and technological trends? Which skills

and competences of employees will be important in the perspective of 5-10 years, taking into account changes and technological trends? The five most likely and growing professions using artificial intelligence include: AI programmer, neural network engineer, data cloud assistant, and managers managing artificial intelligence and implementation of high-tech solutions. (Figure 1). An interesting indication of the area of professions absent on the labor market is a specialist humanizing the work environment. Robotization processes, independent work with machines, devices and robots requires the introduction of elements supporting sudden, not evolutionary changes in the field of communication, meeting the social needs and socializing employees.

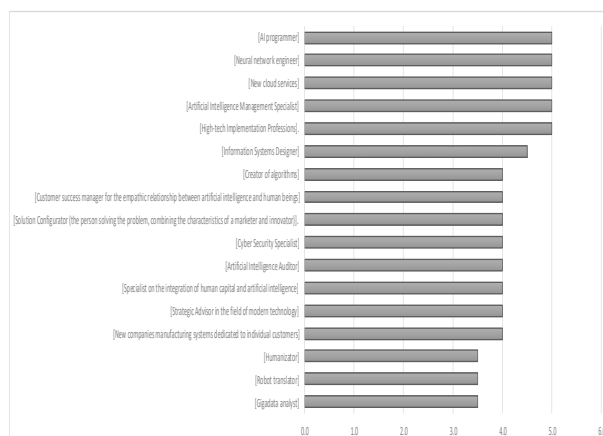


Figure 1. New professions and activities created as a result of the growing importance of AI.

Source: Own study

In the case of competences, all scopes of work and attitudes were taken into account (hard and soft competences). The most desirable skills and competences of employees were identified as three: creativity, commitment, and critical and logical thinking (cause-and-effect thinking) (Figure 2).

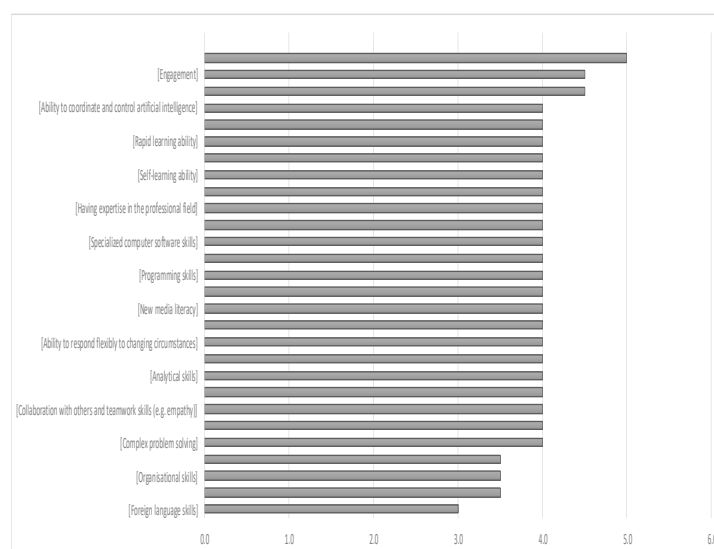


Figure 2. Mastering competence due to technological development

Source: Own study

Interesting conclusions arose as a result of the analysis of the desired and shaped attitudes among employees, especially at the level of primary and vocational education and higher education in the field of formal and informal education. Attention was paid to putting more emphasis on oral exams as the main form of student and student evaluation, limiting the validity of diplomas ("forced refreshment of qualifications"), increasing the importance of postgraduate education (e.g. retraining), introducing IT education at an early stage to identify IT interests,

changing the role of an academic teacher to a tutor (e.g. advisor, talent detector), putting more emphasis on the ability to obtain and select information. A recurring issue is work-study balance (teachers' acquisition of practical competences). The key issue is the cooperation between HEIs and enterprises on the labor market with an emphasis on the dual education system (minimum 30% of classes in practice) and cooperation with practitioners in the education process (Figure 3).

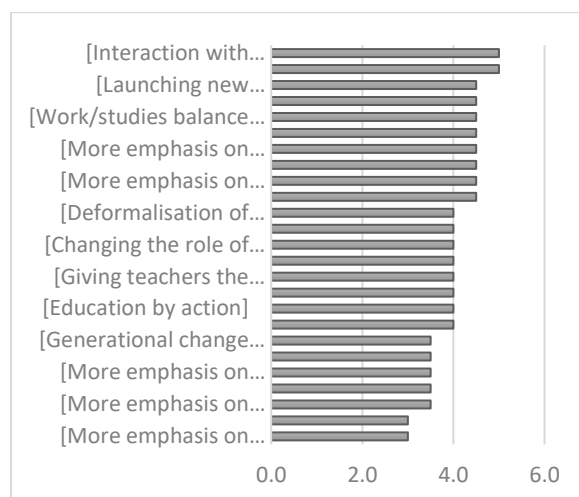


Figure 3. Required changes from the formal education system (HEIs)

Source: Own study

The development of research limiting the scope and area of research on competences, labor market and technology 4.0 was the assessment of the level and attractiveness of competences and skills by both employees and employers. For the purposes of this study, the results of employers' opinion polls will be discussed. Research on identifying the competency gap in the labor market was carried out at the beginning of 2021. The research carried out using the CAWI method was attended by a total of 302 enterprises representing the industrial sector, the business services sector and the public service sector. Among the surveyed enterprises, 49% were small enterprises, 31% medium enterprises and 20% - large enterprises. The answers related to the shortage in the labor market indicated in the question of professional competences and to the assessment of competency shortages in individual age groups of employees. According to the respondents, the greatest shortage of competences (Figure 4) is noticeable in the area of specialist knowledge (20%), responsibility (17%) and in terms of commitment and flexibility - 16% each. The respondents felt the least lack of competences in the field of information-seeking skills (63%). The lack of competences in the area of analysis skills (34%), inference and work organization (33%) or interpersonal skills (32%) was felt to a moderate extent. It is worth noting, however, that to a large or very large extent, the perceived lack of the abovementioned competences did not exceed 20%, which may mean focusing on the current problems of companies and not on the future dominated by solutions of future technologies.

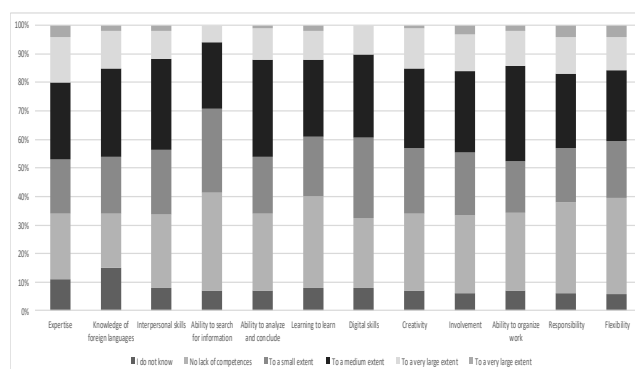


Figure 4. Assessment of employees' professional competences by enterprises

Source: Own study

The respondents were also asked how they generally assess the level of professional competences in the enterprise of employees in particular age groups. The greatest competency gaps were identified in people up to 24 years of age (32%) and people over 60 (15%), but it is twice as low as the lack of competences. It can be assumed that the experience gained on the labor market becomes a valuable element of professional competences.

IV. Conclusions and recommendations

The conducted research has shown that the shortages of competences are the most noticeable in the field of specialist knowledge (direct cooperation with AI, robots, machines) and work in virtual environments (clouds, kubernetes) on very large data sets. At the level of existing enterprises, apart from the lack of hard competences (scientific and social expertise), the necessity to shape attitudes of employee responsibility as well as commitment and flexibility was also indicated. Entrepreneurs focus on the current situation and current problems of companies and not on the future dominated by solutions of future technologies. The shortage of competences is felt the least by large enterprises, perhaps due to the developed strategies and procedures or the training system used. An interesting potential area of conducting further research in the field of professional competences and entrepreneurship development was noted, and it is worth emphasizing that an important element of cooperation with entrepreneurs should be the entrepreneurial ecosystem, in which there are educational institutions that educate appropriate staff. Industry 4.0 has a strong impact on the labor market. Adaptation to changes in the labor market requires appropriate development of competences, with particular emphasis on transversal (entrepreneurial), digital and professional skills. The system of formal and informal education should be changed, assuming that in the coming and ambiguous times, vocational education will require a modular, flexible and consistent with the needs education system and supplementing the skills and qualifications of employees.

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