Research Article

Discrepancy of the Skills:
A Comparative Study of Three EU Countries

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Abstract

Skill mismatch is an important issue, considering the inconsistency in the range of existing and desired skills in different dimensions of consideration. Growing technological pressure, cultural changes lead to obsolescence and loss of skills, making it crucial to thoroughly examine the skill mismatch phenomenon. This article explores the levels of skill mismatch and gaps in Poland, Lithuania, and Germany, and assesses the digital skill levels within these communities.

The article aims to unify the diverse theoretical perspectives on skill mismatch, as revealed through literature analysis. The empirical section demonstrates the widespread and significant nature of this issue. The study's objectives are verified through a review of literature and findings from the European Center for the Development of Vocational Training (Cedefop) reports: "Setting Europe on Course for a Human Digital Transition" (2022) and the "Second European Skills and Jobs Survey" (2023).

The research results underscore the diversity, complexity, and inconsistency of skill levels and mismatches within the EU. The classification of digital skills reveals gaps and disparities, highlighting priority actions for enhancing digital skills across the European society.

Keywords: skills, skills mismatch, skills gap, human capital.

Introduction

The influx of external factors affecting the functioning of enterprises in recent years has surprised everyone. The global market has almost drowned in the number of variables, starting from the pandemic, the war in Ukraine, but also advanced robotics, artificial intelligence (AI), the Internet of Things (IoT) (Cedefop, 2021), and the increase in process automation (Frey and Osborne, 2013; Arntz et al., 2017; Nedelkoska

and Quintini, 2018; Pouliakas, 2018). All of this had a major impact on the workforce and began its transformation, the biggest in several decades.

Designated trends (Deloitte, 2021; Mercer, 2021; Chamorro-Premuzic et al., 2017; Prokopowicz, 2021) and undertaken research directions have recently been significantly destabilized due to the emergence of unforeseen challenges, the scale and scope of which have

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often shocked enterprises. Since 2020, organizations around the world are being forced to adapt to radical new ways of working and organizational processes due to the impact of the pandemic and the Ukrainian war on people and economic conditions.

The theory of human capital assumes consistency between the level of remuneration and the human capital possessed by the employee (Becker, 1964; Mincer, 1974). Unfortunately, this theory is extremely often wrong, due to the actual relations between the demand and supply side of the labor market. The conducted research observed that developing workers' skills is important but not sufficient. Skills should be used to the extent consistent with the needs of the organization (Scottish Government ,2008; Skills Australia 2010). Lack of consistency leads to mismatches in terms of human capital in areas of knowledge, competence, experience, skills or motivation. Mismatch concerns the failure to use human capital (HC) in enterprises resulting from the inconsistency of employees' competences with the requirements set by enterprises. In the literature, it is referred to as a skills-mismatch approach (European Commission, 2012). Skills mismatch is a diverse issue in many ways in how it manifests itself and how it is measured, conditioned, and how its consequences are felt. Some of the studies that are carried out look at mismatches from the point of view of employees (Hirzel et al. 2017; Belfield, Sloane 1999; Dolton and Vignoles 2000), while others look at employers and difficulties at company level (McGowan and Andrews 2015; McGuinness, Pouliakas, Redmond, 2018). Different approaches to the concept of skills mismatch cause difficulties in defining, categorizing and measuring. Verifying the sides of the labor market, measures of mismatch can be divided into two groups, measured through the prism of an employee or enterprise. Research tends to focus on the extent to which workers possess the skills or level of education required to perform their job duties (Cedefop, 2010; Quintini, 2011; Cedefop, 2015a). It can be divided into surplus and deficit measures of human capital.

The definition of skills usually refers to the characteristics possessed by employees and the abilities required to perform specific job tasks (Cedefop, 2021). Defining skills often takes into account the ability of workers to respond to the complexity of the job and the value of skills as part of organizational processes. Definition ambiguity is not the only problem with skills. Due to the specificity based on the foundations of the concept of human capital and its uniqueness and complexity, skills also have a complex and multidimensional character. Thus, no research process can define a complete skill set for a job, process or employee. Skill definitions include manual, verbal, or mental dexterity to manipulate resources. Then it is possible to measure them through the efficiency test, which verifies the quantitative and qualitative parameters per unit of time. Skills are therefore acquired through both experience and training. They reflect whether the investment in building knowledge and developing the human capital of the unit was justified and allowed to obtain an adequate return. Nevertheless, it is the experience and the transformation of education processes that make it necessary to change, update and supplement the scope of skills, which further complicates the measurement and analysis processes.

The main goal of the article is to better understand the category of mismatch and the implications for the theory of human capital related to technological progress. The article attempts to answer the question of the status and diversity of selected SMM categories in Europe. The article includes information on how skills mismatch is defined and classified, what contributes to the creation of mismatches and what significance the digitalization process has for the phenomenon. To achieve the goal adopted in the article, an empirical study was planned to assess skills mismatch in the selected EU countries.

The structure of the work takes into account the following division of the presented content: the first part contains a theoretical characterization of mismatched skills and methods of its verification. The second part takes into account the methodology of the author's own research. The third part includes results on skills mismatch and gaps and the digitalization of skills in the selected EU countries. The fourth part of the work is a summary and a starting point for discussion. It also includes practical implications that may have a positive impact on reducing the scale of the phenomenon.

Skills mismatch is a confusing term as it can reflect both skills shortage and skills surplus. The skills mismatch can be translated into the misuse of HC in enterprises, which results from the inconsistency between the competencies of employees and the requirements of the enterprise (European Commission, 2012). The theory of human capital (Becker, 1964; Mincer, 1974) assumes that a person will be rewarded according to his or her human capital, however,

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in the event of a skills mismatch, the employee is not remunerated adequately to the potential at his disposal products (Green, 2010; Allen and Velden, 2007). A skill mismatch occurs when an employee's skill level is higher or lower than the level required for the job. If the level of skills is higher than required to perform work in a given position, then the employee is classified as overqualified; if the opposite is the case, the employee is defined as low-skilled (Krahn and Lowe, 1998).

Studies conducted by the OECD have shown that over 40% of workers in Europe and other OECD countries believe that their level of skills is not consistent with the level required for a given position. In most countries, employers report difficulties in recruiting workers for given positions, which may suggest an inability to meet the needs with the skills available on the labor market (OECD, 2016). Factors determining the occurrence of mismatches causing inconsistencies in the employer's needs and the skills resources of a potential employee may result from many variables that can coexist in various combinations and with different intensity; their classification is presented in table 1.

Table 1. Factors behind skills mismatch

Conditions for the occurrence of skills mismatch			
Structural	**Social-Economic**	**Educational**	**Technological**
Low level of labor mobility within different types of economic activity and in the regional dimension.	Transformation of the way enterprises operate based on, among others, downsizing, rightsizing and lean production models.	Low level of adaptation of education and training systems and thus skills to process transformation processes in organizations.	Improvements in computer technology over the last decades have provided companies with cheaper machines and software that serve to increase the automation of the work process.
Occurrence of shortages of specific professional groups related to mismatches in terms of qualification requirements or information problems related to job placement.	Increasing dependence between domestic jobs and the process of economic globalization, economic cycles and exogenous shocks.	Changes in the scope of skills requirements caused by the expansion of compulsory and higher education, and general improvements in the quality of education.	Improvements in technology have enabled the implementation of offshore work processes or influenced the individualization of projects, reducing the need and scope of interaction.
Occurrence of shortages resulting from the existing public policy and applicable legal regulations.	Low level of labour mobility due to cultural factors.	Inconsistent systems for validating skills and competences can lead to mismatches.	Technology is influencing the ways and mode of communication.
Mismatches conditioned by the characteristics of the work process, taking into account the working time and the type of contract.	Demographic changes related to the increase in the female workforce, increasing migration flows, and the transformation of pension systems.	Inadequate training systems can cause discrepancies due to skills becoming outdated due to changes in organizational processes or adoption of new technologies.	
Changing social attitudes in the field of work-life balance, the importance of lifelong learning, effective VET programs, and competence testing.	Mismatches caused by an aging population or a general reduction in the available workforce.	Improper implementation of personnel processes, especially planning and recruitment, may generate inconsistencies or inadequacies in engaging the possessed potential.	

Source: Authors' own study based on Getting Skills Right: Skills for Jobs Indicators. Skills Mismatches an Impediment to the Competitiveness of EU Businesses p.15, Getting Skills Right: Assessing and Anticipating Changing Skill Needs s.7

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It is worth emphasizing that even well-functioning educational systems or economic and social changes do not guarantee full matching of skills. Chronic skills mismatch or shortages in the longer term can have adverse economic consequences for individuals, businesses and the economy as a whole. At company level, skills shortages affect the ability of enterprises to implement innovations and adopt new technologies; they also increase recruitment costs. Skills mismatch, on the other hand, has a negative impact on job performance due to the inadequate matching of employees to workplaces; it is also associated with reduced productivity and increased turnover in the workplace (Cedefop, 2019). Skills mismatch can, on a larger scale, generate greater risks of unemployment, lower wages, lower job satisfaction or a general worsening of job prospects (OECD, 2016). The occurrence of a mismatch increases the level of structural unemployment, lowers the level of economic production relative to the potential level of production and limits GDP growth through inappropriate allocation of human capital (OECD, 2017).

Theoretical Background

The problem is not only the reasons or effects of mismatches. Much in the field of research and reasoning on this subject is conditioned by a proper categorization of the concepts considered within the skills mismatch concept. The classification of issues, and thus the areas of measurement, are conditioned primarily by the needs of the researcher or the possibility of making comparative analyses. As a result, in most cases, individualized classifications are made that correspond to the specific needs of a given company's skills needs or are based on previously used divisions built on the theoretical achievements of the concept.

Some of the skills mismatch classifications concern professional requirements and skills; they define levels for educational skills or experience in a given professional activity. The next categorization allows for greater utility value and comparability of analysis results by dividing skills into the most general categories possible, i.e. cognitive, interpersonal and manual. In recent years, an area of increasing importance is the group of digital competences. They are responses to the growing importance and connection of technological development with work processes. Selected classifications are included in figure 1.
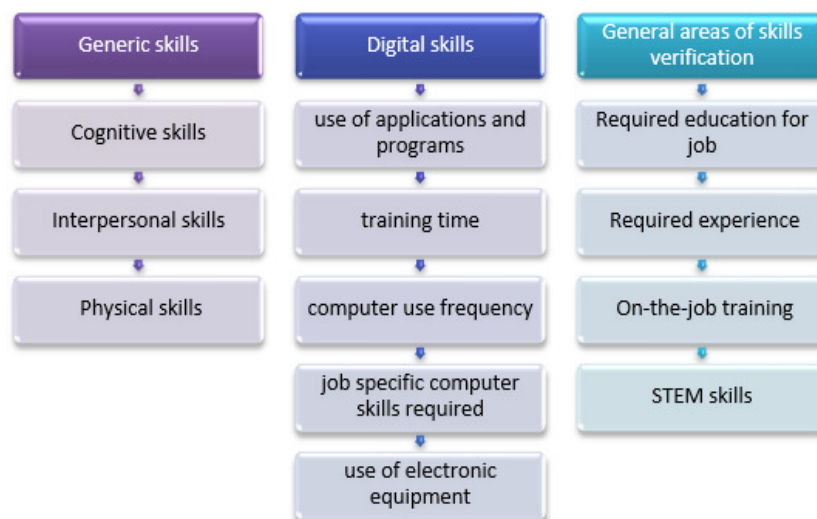

Fig 1. Skills categories

Source: Authors' own elaboration based on OECD (2016), Getting Skills Right: Assessing and Anticipating Changing Skill Needs, OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264252073-en; Cedefop (2021). Understanding technological change and skill needs: skills surveys and skills forecasting. Cedefop practical guide 1. Luxembourg: Publications Office. http://data.europa.eu/doi/10.2801/212891

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The division of mismatch measures can also be divided taking into account measurement scales. In this area, mismatches occurring from the point of view of an individual or those that shape the state of the entire enterprise are taken into account. The mismatch from the individual's point of view is primarily verified by the level of education or skills that may be above or below those required for a given position. The scale of the enterprise is based on analyses of skills gaps or skills shortages. Skills gaps refer to a situation where employees do not have the competencies

adequate for the position. On the other hand, skills shortages arise when an employer cannot fill specific positions with suitably qualified staff (Cedefop, 2010; Quintini 2011; Cedefop, 2015a ; McGuinness et al., 2017).

Studies on individual skills mismatch are part of the HC underutilization concept, under which another classification of skills mismatch is developed. Figure 2 shows the classifications and definitions of SMM types.

Skill shortage • Occurs when the demand for a specific skill exceeds the number of people with that competence, or vice versa.

Skill gap • A situation in which the level or type of an employee's skills differs from those required to properly perform the job.

Skill surplus • Occurs when the number of people with a given skill exceeds the actual demand for it.

Vertical mismatch • Refers to a mismatch between the level of education or qualifications and the requirements of a given position.

Horizontal mismatch • Refers to a situation when the field of education, field of knowledge or skills do not match the requirements of the job.

Overeducation/Undereducation • Occurs when employees have more or fewer years of education than is required for a given position.

Overqualification/Underqualification • Refers to an employee having higher or lower qualifications than a given profession requires.

Overskilling/Underskilling • Means that an employee is unable to fully use their skills in a given job or does not have sufficient competences to perform duties at an appropriate level.

Skills obsolescence • Describes a situation in which previously required skills become obsolete or degraded over time.

Crowding out/bumping down • A phenomenon in which people with higher skills take up positions intended for people with lower skills, pushing them out of the job market.

Fig 2. Skills mismatch classification
Source: Authors' own elaboration based on Maltseva V. (2019)

Another example of skills imbalance classification is the OECD Skills for Jobs Database. The approach to verifying competency shortages that has been applied divides the research areas into three main domains: skills, knowledge and abilities. The skills categorization includes the following:

- content skills areas, which include reading comprehension, writing, speaking and active listening,
- process skills including critical thinking and active learning,
- skills in solving complex problems,
- social skills including instructing, social perceptiveness (OECD, 2017).

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The various concepts of skills mismatch mentioned above are very different in terms of how they manifest themselves, their measurement, their determinants and how their consequences are felt. Some relate to mismatches experienced by employees, while others relate to employers and firm level difficulties.

Measuring Skills Mismatch

Measuring skills mismatch is a difficult process for many reasons. First of all, it does not have the feature of comprehensiveness; it is not possible to verify all the skills that characterize a given profession or position (Cedefop, 2021). Secondly,

it is not possible to verify individual occupations in detail, as such a study will exclude comparability. As a result, the measurements performed are in the nature of verification of the general categories of skills. In addition, the skills mismatch study is based on the analysis of specific data in the current time, and the mismatch phenomenon itself assumes the verification of the relationship between the state and the competency requirements in time. In addition, in the research process, there is always a time gap between the implementation of the process and the publication of its results. Figure 3 shows some of the methods used in the skills data collection process.
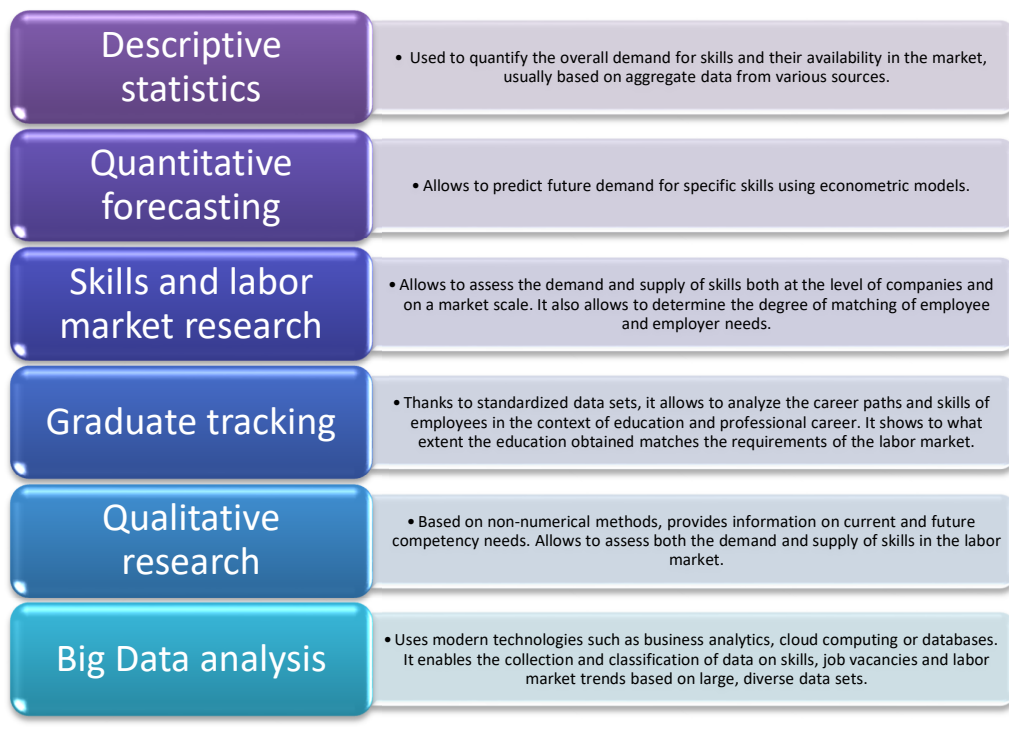
Descriptive statistics
• Used to quantify the overall demand for skills and their availability in the market, usually based on aggregate data from various sources.

Quantitative forecasting
• Allows to predict future demand for specific skills using econometric models.

Skills and labor market research
• Allows to assess the demand and supply of skills both at the level of companies and on a market scale. It also allows to determine the degree of matching of employee and employer needs.

Graduate tracking
• Thanks to standardized data sets, it allows to analyze the career paths and skills of employees in the context of education and professional career. It shows to what extent the education obtained matches the requirements of the labor market.

Qualitative research
• Based on non-numerical methods, provides information on current and future competency needs. Allows to assess both the demand and supply of skills in the labor market.

Big Data analysis
• Uses modern technologies such as business analytics, cloud computing or databases. It enables the collection and classification of data on skills, job vacancies and labor market trends based on large, diverse data sets.

Fig 3. Methods of collecting data on skills and their specificity

Source: Authors' own elaboration based on Cedefop (2021). Understanding technological change and skill needs: skills surveys and skills forecasting. Cedefop practical guide 1. Luxembourg: Publications Office. http://data.europa.eu/doi/10.2801/212891, p.15, Rikala, P., Braun, G., Järvinen, M., Stahre, J., & Hämäläinen, R. (2024). Understanding and measuring skill gaps in Industry 4.0 — A review. Technological Forecasting and Social Change, 201, 123206. https://doi.org/10.1016/j.techfore.2024.123206 p. 2

The factor influencing the measurement of skills mismatch is the variability and instability of the environment. Changes in the conditions of design and technological evolution are a real game changer for the way employees work in an organization, for specific spheres of activity or specific professions. Taking into account the conditions described above, the measurement of skills mismatch, which allowed to determine the

skills needed in the future, is a difficult but extremely important activity.

The Skills mismatch study is also related to such phenomena in the labor market and economy as underemployment rate, structural unemployment, job polarization, and income inequality. These issues are characterized by a significant dependence on skills mismatch. This

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phenomenon is particularly visible in Europe, which is characterized by unfavourable demographic trends (EESC, 2018). However, despite numerous limitations, it should be undoubtedly recognized that SMM is so important that any research process that increases the level of knowledge and understanding of this phenomenon is advisable.

Methodology of the Research

In order to verify the primary goal of the research process regarding better understanding of the mismatch category and the implications for the theory of human capital related to technological progress, an empirical study was carried out to assess the scale of skills mismatch in the EU and the selected countries. The study attempted to answer questions about selected types of mismatches and gaps in skills and digital skills in the analyzed countries.

Literature studies and analysis of empirical research allowed the formulation of the following hypotheses:

• H1 The development of digitalization causes an increase in the SMM phenomenon.
• H2 Mismatch of employee qualifications is dominant.
• H3 Digital skills at medium level are common.

The verification of the first hypothesis is based on the presentation of literature considerations and the results of research processes dealing with the subject of SMM. The presented trends and directions of research and their scopes aimed at verifying the impact of technological changes on behavioral processes; development activities and skill-building activities show a clear tendency. Namely, ongoing technological progress clearly shapes the directions of changes in the area of skills, proving the increasing importance of digitalization for the formation and development of human competence potential. The presented literature review allows for a positive verification of the first hypothesis.

In order to verify the second and third hypotheses included in the article, the results of the research conducted by the European Center for the Development of Vocational Training (Cedefop) will be presented. The second hypothesis emphasizes the importance of including the employers in the process of building skills matching. It assumes that the mismatch taking into account the inconsistency of employee qualifications indicates insufficient inclusion of this group in the processes of

shaping competence scopes built through education and training. The survey whose results will be used to show the current state of affairs is Cedefop's Second European Skills and Jobs Survey (ESJS) conducted from 2018 to 2024 and is a periodic survey that gathers information on job skills requirements, digitalisation, skills mismatch and workplace learning (ESJS, 2023). The survey was conducted in all EU countries as well as Iceland and Norway, based on representative samples among employees. The study was conducted using a standardized methodology to provide information on the impact of digitalisation on the future of work and skills. The methodology of the process was based on the use of the following techniques: computer assisted telephone interviewing (CATI) and computer assisted web interviewing (CAWI). A total of 46,213 interviews (telephone and online) were conducted (Cedefop, 2021). The study was divided into 10 thematic areas concerning individual areas and types of skill mismatch and skill gaps, but also education processes, job satisfaction or the impact of covid-19 on the work process.

The third hypothesis concerns the development of future skills. It assumes that the level of digital skills in the European society is generally good. Which would indicate the universality and accessibility of processes shaping this area of skills. In 2022, Cedefop published a report, "Setting Europe on course for a human digital transition" (Cedefop, 2022), in which the digitization process in Europe was researched. Data for the research included in the report were collected among adults aged 25-64, employed, living in private households, whose place of residence is in the territory of each of the EU-27 Member States as well as Iceland and Norway. The research was carried out between May and August 2021. A total of over 46,000 interviews were conducted. In all countries except Cyprus and Malta, a dual interview system (telephone and online) was implemented. In each country, the probabilistic research sample included 500 respondents, except for Finland, Iceland and Norway, where population registers were used (Cedefop, 2022). The verification of hypotheses will be divided according to their order of presentation in the article.

As part of this study, the results of skill gaps and skill mismatch will be presented for the average of EU countries and for three selected countries: Germany, Poland and Lithuania. The reason for such a selection is to maintain the consistency of

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the scope of the presented results with the project implemented by the author of "Work of the Future", whose participants are the countries listed above.

Presentation of Research Results

The motivation to undertake part of the research on the scale and types of mismatches and to focus on the category of digital skills is the verification of the current achievements in the field of SMM analyses. The results of the research show that there are already significant mismatches between the needs of the labor market and the potential of university graduates (ETP,2022, Cedefop, 2010, Predovic, Dennis, 2020, Kentaro 2020). The conducted research on the skills in general allowed the following conclusions to be obtained:

- transformation of the work environment influences changes in the implementation of personnel processes, control of work results (van Vulpen, 2021; Dettmers et al., 2013),

- nearly 60% of the employees want to work remotely full-time after the pandemic (Totah, 2021; Apollotechnical 2020),
- the vertical mismatch preserves some of the specific human capital acquired through formal educational qualifications (Salas-Velasco, 2021),
- there is a greater likelihood of a horizontal mismatch among graduates from majors that provide more general skills (Robst, 2007).

The verified research results concern selected areas of skills mismatch and skills gap and take into account average values for all countries participating in the study. Figure 4 includes the results of the mismatch of qualification with job assessment. Higher level of qualifications than job required is declared by 26% of the surveyed Europeans. Lithuania shows the highest level of mismatch in this aspect which is 38%. Among the considered SMM categories for vertical mismatch, there are the highest values, which indicate that every fourth study participant has a mismatch of qualifications.
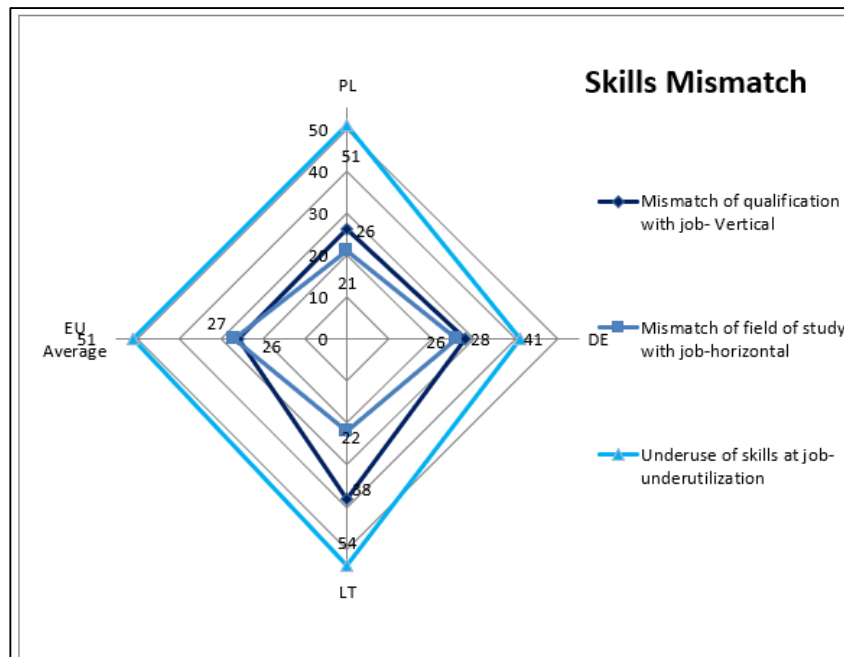

Fig 4. Selected types of skills mismatch

Source: Authors' own study based on Introduction | CEDEFOP (europa.eu)

The second type of mismatch takes into account the consistency between the field of study with the job. The levels of responses indicating that the job is fully consistent with the scope of education are shown in the graph; the average for EU countries for horizontal mismatch is 27%.

The last area of mismatch concerns the underutilization of skills. More than half of the respondents (51%) from the EU countries stated that they are characterized by a high degree of underuse of skills at work. Only Germany

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achieved an underutilization level lower than 50%.

General conclusions are not optimistic, they indicate that there is a high level of skills mismatch among EU countries - it concerns 51% of the respondents. The verified assumption concerned the predominance of qualification mismatch over education mismatch. Based on the data presented, this advantage is only 1% for the EU average. However, it concerns over 1/4 of the survey respondents, which indicates the importance of a phenomenon that requires in-depth analysis.

Another verified issue was the area of skill gaps. Within which gaps were verified in accordance with one of the frequently used classifications, namely gaps in the areas of numeracy, social and technical skills were taken into account. The results for the selected EU countries and the average for the Member States of UE EUare included in figure 5.

Almost a third of workers in the EU felt they needed training in numeracy. The greatest need to acquire these skills among the presented countries was reported by employees from Poland. Nevertheless, the largest gap among the examined types of skill gaps occurs in the field of social skills. Half of the respondents from EU countries declare that they need to supplement their social skills. This is the skill group with the biggest gap for all 27 countries. In the case of the selected countries considered in the article, Poland again showed the existence of the largest gap at the level of 61%. The last area of skill gaps are technical or job-specific skills. The need to improve qualifications in this area for the entire EU is declared by 42% of the respondents. This is the second largest skill gap and again the largest among employees from Poland, who exceed the EU average by 5 percentage points. Demonstrated skills gaps are usually based on exogenous variables - systemic, economic or educational - they are dictated by inconsistencies that have been developing since the beginning of the process of shaping an individual's skills, their change requires multi-aspect, systemic transformations, the implementation of which requires many years, not to mention the effects of such activities.
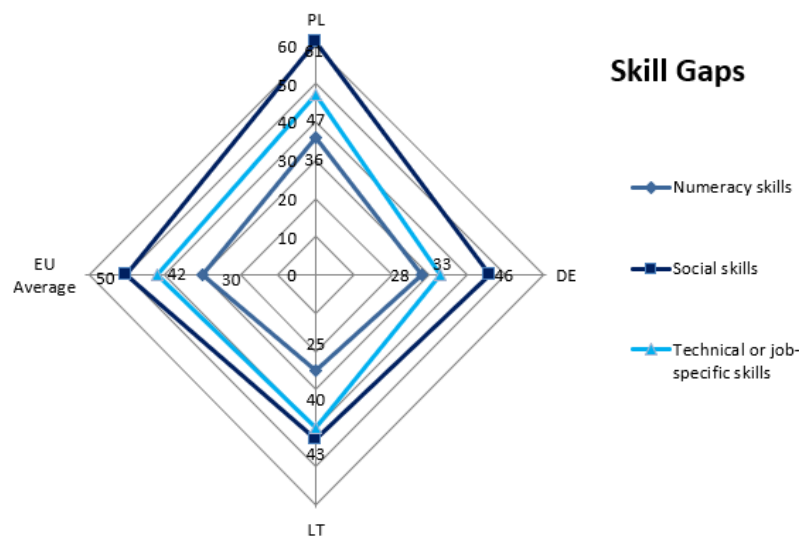

Fig 5. Selected types of skills gaps

Source: Authors' own study based on Introduction | CEDEFOP (europa.eu)

In general, the level of skill gaps for the discussed countries was in no case lower than 25%, which indicates that in each area more than 1/4 of the employed population shows the need to improve and develop their skills. Technical competences are a group that has been significantly expanded in the face of the experience of recent years. Research in the field of skill mismatch and skill gaps is supplemented with verifications in the field of digital skills. In a situation where over

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86% (Cedefop, 2023) of working people declare that they use digital devices in the performance of their duties, this means that this skill area is also gaining in importance as generic skills areas. This allows for positive verification of the adopted hypothesis.

Verification of the hypothesis assuming that digital skills at medium level are common

Digital transformation is not the future of work, it is an ongoing phenomenon. The integration of new digital technologies into the area of work with a view to more advanced technological progress will take place soon. Research from Cedefop reports (Cedefop, 2021) suggests that, for many European workers at the bottom of the labor market, digital skills transformation is not yet a reality. Among other things, the respondents answered the question to what extent new digital or computer technologies in your organization can do their main work. And so, 26% of the respondents from Poland, 44% of Germans and 40% of Lithuanians stated that their work is not influenced by digital technology at all. The average for EU countries is 34%. In the years of the 2020-21 pandemic, almost half of the working adults experienced the implementation of new digital technology in the workplace, and from 35% the implementation required learning how to use this technology. The UK Skills Mismatch in 2030 report published in 2019 indicates that the biggest skills mismatch will be in basic digital skills. It is predicted that by 2030, 5 million British workers could become significantly mismatched in basic digital skills (ISC, 2019). Therefore, there is no doubt that it is necessary to verify the level of digital skills, to increase the awareness of the community about them, but above all to build and develop them.

More and more research concepts of skills and their mismatches include the level of digital skills in their scope. Within the generic classification, next to such areas of skills as interpersonal, manual or cognitive, digital becomes the 4th pillar.

Digital skill gaps verification is usually divided into the main group of respondents: users of digital technology in their work and individuals who do not use digital tools to perform the main scope of duties. When examining the level of digital skill, the scope or fact of using specific technologies is often verified. Referring the verification of digital skills to the issues presented in the article, the levels of mismatch will be presented based on the US STAMP

(Handel, 2016) requirements in the field of digital skills.

The study of skill gaps in the field of digital skills is divided into a 10-step scale of advancement, which applies to specific levels of digital skills. It takes into account the factors included below. Verification of digital skill gaps for the selected European countries will be presented and discussed in accordance with the above classification.

1.   use of computer devices,
2.   using the Internet,
3.   word processing,
4.   creating a presentation for work,
5.   using spreadsheets
6.   using advanced spreadsheet features
7.   using specialized software
8.   manage or connect databases
9.   coding using a programming language
10.   ICT development or maintenance (Cedefop, 2023).

Cedefop's 2015 Skills and Jobs Survey found that more than eight out of 10 jobs in the EU require at least a basic level of digital competence (Cedefop, 2015a). For over a decade, social awareness has been growing, built by clear and legible signals from enterprises about the need to increase the level of digital competence in order to meet the technological development of organizational processes. However, the values shown in Figure 3 do not indicate a high level of investment in digital technology in EU economies and companies. They show the existence of a certain inconsistency in the narrative or actions that allow for the rapid spread of advanced digital technologies. Of course, this state can be attributed to the fact that it is based on unrepresentative data, analyses of professions requiring low levels of digital competence, uneven distribution of the use of digital skills in specific industries, but it is important that the problem is not the research process, which Cedefop has repeatedly proven in its research, but the information obtained. Data show what the level of digital skill is and how uneven and unsatisfactory it is.

The analysis of the levels of digital competence mismatch concerns employees who do not rely on the digital area in their work, i.e. the value of their work does not directly depend on the use of specific digital skills. Nevertheless, verifying the market and technological requirements, the digital development of civilization, 10 digital skills were distinguished, which can be divided according to the level from basic to highly

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advanced skills. The extracted skills were divided into 5 levels, the synthetic interpretation of which was made in table 2.

Table 2. Classification and characterization of digital skills levels

Skill level	Type of skill	interpretation
Basic	• use of computer devices, • using the Internet,	a level that enables virtual communication
Fair	• word processing, • creating a presentation for work,	a level based on the ability to integrate digital skills into current professional duties
Medium	• using spreadsheets • using advanced spreadsheet features	a level capable of supporting action through the use of more advanced forms of information technology
Advanced	• using specialized software • manage or connect databases	specialist level, indicating a high ability to generate information that is the basis for decision-making processes or an important sphere of activities at the workplace
Highly Advanced	• coding using a programming language • ICT development or maintenance	a level enabling the creation and development of the added value of activities based on the creation and development of information technology

Source: Authors' own study

Figure 6 includes data presentations for the selected EU countries and average values for all EU countries. Analysis of the obtained results allows the following conclusions to be drawn:

- more than 1/3 of the employees in the EU use a computer device in their work,
- almost 3/4 of the respondents declare the use of the Internet in the fulfilment of employee duties, making it the most common digital work activity,
- more than half of the employees declare that, while working, they write or edit text, for instance using Word or similar software,
- the highest level of literacy was recorded in Lithuania at 75%, and it relates to the use of the Internet at work,

- the lowest level of skills applies to write programs using artificial intelligence methods, in this respect only 5.5% of the respondents across the EU declare having skills,
- across the Union, just over 8% of the employees have advanced and higher digital skills,
- the lowest levels of skills are in Germany for the category of highly advanced skills are 2% and concern writing programs using a programming language and write programs using artificial intelligence methods, and develop or maintain IT systems.
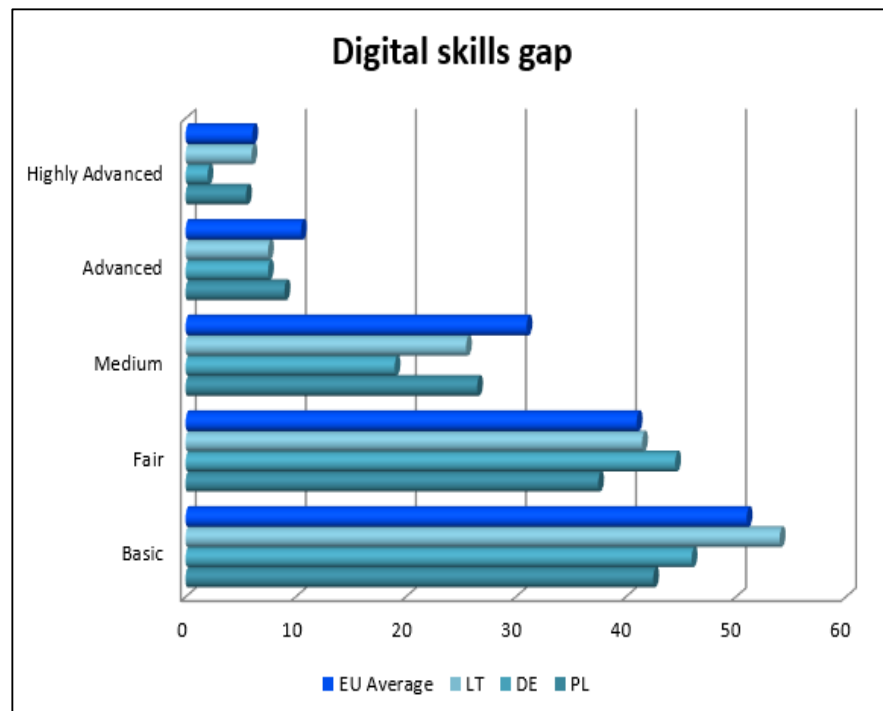
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Fig 6. Digital skills gap across chosen UE countries
Source: Authors' own study based on Setting Europe on course for a human digital transition

The levels shown in relation to the selected EU countries indicate that, above all, actions should be taken and programs that develop digital skills at higher levels should be created. The results of the research indicate the possibility of further development of the level of digitization of workplaces in Europe. Research results indicate the possibility of further development of the level of digitization of workplaces in Europe, especially in more advanced skills, the level of which does not even exceed 30% of the respondents, which means that only 2-3 people out of 10 are able to use the more advanced functions of spreadsheets, manage databases, write programs or code using a computer language or artificial intelligence methods, develop IT systems. This requires interventions and coordinated actions aimed at stimulating a better adjustment of education and training processes to market needs. The hypothesis about the average level of digital skills among the population of EU countries was verified negatively.

Summary and Discussion

Skills imbalances are therefore an indisputable phenomenon that occurs quite commonly, as indicated by the presented partial research results. The mismatch assessment process and any attempt to forecast the demand for specific types of skills are only the first step in addressing the existing problem. Actions aimed at better matching supply to demand cover various areas of intervention, concern lifelong learning, and active and passive labor market policies. An effective strategy of building and developing digital skills and minimizing the skills mismatch on a national or even EU-wide scale requires taking multidimensional measures, aimed at various fronts. Table 3 presents the main areas of intervention and the measures proposed for implementation.

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Table 3. Directions of actions reducing the skill mismatch in specific dimensions

Activities that include employers	Actions that take society into account	Activities involving organizations
Ensuring conditions, programs and regulations regarding the involvement of employers in the development of vocational education.	Ensuring access to reliable and up-to-date career guidance services	Building relationships between educational institutions and fields of study and qualifications needed on the market by co-financing strategic teaching courses.
Ensuring constant and formalized input of academics in shaping education programs at the higher education level. Development of apprenticeship programs by building industry-specific apprenticeship programs.	Developing programs, identifying stakeholders at the level of vocational and secondary education regarding educational programs, creating development paths and reliable career advice.	Linking state funding supporting education with the results of employment of graduates of universities and vocational schools.
The possibility of developing rules and guidelines for the financial participation of employers in paying for specific training classes and internships. Creation of a tax on practices, which gives employers the opportunity to decide or co-decide about entities that will be subsidized.	Increased number and regularity of contacts between the employer and a student of a secondary or vocational school. Employer interactions like work visits, internships, employer-judged science fairs, and mentoring strengthen students' commitment to education and training.	Creation of educational programs and courses on building and developing digital competences. They constitute a deficit competence area of most European Union countries.
Providing motivators in the form of financial incentives for employers, subsidies, or tax reliefs for entities that implement apprenticeship programs.	Creating free training programs for employees with low levels of skills and qualifications, which will contribute to levelling out disproportions in the Lifelong learning process.	Including learning in the field of digital technologies at the lowest levels of education in order to ensure basic digital skills as early as possible and systematic and systemic development of their levels.
Formal and technical support for SME entities in the development of apprenticeship programs in order to increase their participation in such programs.	Providing free access to career counseling for adults planning to change and transform their career path.	Training for teachers at different levels of education in the use of digital tools and their inclusion in teaching practices, applications of digital tools in various disciplines.
Obligatory creation by employers of training funds in the scope of specific areas of key skills, from a certain percentage of funds allocated to employee remuneration.	Creating a system of financial incentives: scholarships, funds, grants that relate to skills and professions characterized by an above-average level of mismatch.	Changes in education curricula, including the development of new teaching methods to understand the current digital culture, including social media.
Ensuring an increase in programs and activities that allow for learning in the workplace.	Scholarships or paid holiday internship programs for students undertaking specific subjects, courses, fields of study with a high demand for skills.	

Source: Authors' own elaboration based on Cedefop 2018, 2021, 2022, 2023; OECD 2017

In the near future, skills mismatch will be an element of the strategy to counteract the decline in economic results based on the optimization of personnel processes. The SMM is created by insufficiently matched mechanisms for strengthening, using, matching and integrating skills in the process of employee development and the education system. The presented research results indicate the diversity, complexity and inconsistency of skill levels and their mismatches in the EU. The article is an attempt to systematize and categorize the SMM phenomenon. The article identifies actions that can reduce the levels of inconsistency in the area of skills mismatch. Including skills mismatch research in organizational processes allows for a

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better understanding of the organization's ability to achieve goals, employee motivation, organizational effectiveness, gender imbalance, productivity and unemployment.

Technological changes affect almost every aspect of human life. The ability to maintain and develop human competences is a determinant of its survival and the continuity of the activities in which it engages. Digitization is entering new areas, causing changes in the relationship of processes, the use of resources and in education. The article shows what level of digital skills is represented in the selected EU countries and on average for all member states. The classification of skills shows gaps and disproportions, showing what activities should be considered a priority in the area of building digital skills of the European society. The occurrence of skill gaps is the first signal alerting us to the consequences of mismatches, which requires a decisive response.

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References

- Allen, J. and R. Van der Velden (2007). "Transitions from Higher Education to Work", in *Careers of* University Graduates. Netherlands: Springer
- Apollotechnical (2020) Surprising working from home productivity statistics, https://www.apollotechnical.com/working-from-home-productivity-statistics/
- Arntz, M.; Gregory, T.; Zierahn, U. (2017). Revisiting the risk of automation. Economics Letters, Vol. 159,
- Battu, H., Belfield, C. and Sloane, P. (1999) Over-education among graduates: a cohort view. Education Economics, 7
- Cedefop (2010). The skill matching challenge: analysing skill mismatch and policy implications. Luxembourg: Publications Office.
- Cedefop (2010). The skill matching challenge: analysing skill mismatch and policy implications.Luxembourg: Publications Office.
- Cedefop (2015). Skills, Qualifications and Jobs in the EU: The Making of a Perfect Match?:
- Cedefop (2018). Insights into skill shortages and skill mismatch: Learning from Cedefop's European Skills and Jobs Survey, Reference series 106, Luxembourg: Publications Office of the European Union.
- Cedefop (2019). The online job vacancy market in the EU: driving forces and emerging trends. Luxembourg: Publications Office. Cedefop research paper; No 72. http://data.europa.eu/doi/10.2801/16675
- Cedefop (2021). Understanding technological change and skill needs: skills surveys and skills forecasting. Cedefop practical guide 1. Luxembourg: Publications Office. http://data.europa.eu/doi/10.2801/212891
- Cedefop (2022). *Setting Europe on course for a human digital transition: new evidence from Cedefop's second European skills and jobs survey*. Luxembourg: Publications Office. Cedefop reference series; No 123 http://data.europa.eu/doi/10.2801/253954
- Cedefop (2023), Second European Skills and Jobs Survey (ESJS) ,European skills and jobs survey (ESJS) | CEDEFOP (europa.eu)
- Chamorro-Premuzic T., Adler S., . Kaiser R.B., What Science Says About Identifying High-Potential Employees, Harvard Business Review , Oct 3, 2017
- Deloitte (2021) The social enterprise in a world disrupted, leading the shift from survive to thrive, 2021 Deloitte Global Human Capital Trends
- Dettmers, J., Kaiser, S., Fietze, S. (2013). Theory and practice of flexible work: Organizational and individual perspectives. Introduction to the special issue. *Management Revue*, *24*(3), 155-161.
- Dolton, P.J. and Vignoles, A. (2000) The incidence and effects of over-education in the graduate labour market. Economics of Education Review, 19, 2, 79-198
- ETF (2019), The European Training Foundation Strategy 2027,
- European Commission (2012). Employment and social developments in Europe 2012.

_____

Luxembourg: Publications Office. http://dx.doi.org/10.2767/86080

- European Economic and Social Committee (EESC) , (2018), Skills Mismatches ,An Impediment to the Competitiveness of EU Businesses, Institute for Market Economics, Bulgaria QE-02-18-922-EN-N 978-92-830-4159-7 10.2864/052607
- *Evidence from Cedefop's European Skills and Jobs Survey*, Cedefop Reference Series 3072.
- Frey, C.B.; Osborne, M. (2017). The future of employment: how susceptible are jobs to computerisation. *Technological Forecasting and Social Change*, Vol. 114, pp. 254-280.
- Green, F. and Y. Zhu (2010). "Overqualification, Job Dissatisfaction, and Increasing Dispersion in the Returns to Graduate Education", *Oxford Economic Papers*, 62 (4): 740-763.
- Handel, M.J. (2016). What do people do at work? A profile of US jobs from the survey of workplace skills, technology, and management practices (STAMP). Journal for Labour Market Research, Vol. 49,
- Hirzel, A. K., Leyer, M., Moormann, J. (2017). The role of employee empowerment in the implementation of continuous improvement. *International Journal of Operations & Production Management*.
- ISC (2019) Industrial Strategy Council: UK Skills Mismatch in 2030, https://industrialstrategycouncil.org/sites/default/files/attachments/Rising%20to%20the%20UK%27s%20skills%20challenges.pdf
- Kentaro A, Breda T.,Rain A., Romanello L., Sangnie M. (2020). Education, skills and skill mismatch. A review and some new evidence based on the PIAAC survey. [Research Report Rapport IPP n°26, Institut des politiques publiques (IPP)
- Krahn, H. and G. Lowe (1998), "Literacy Utilization in Canadian Workplaces", Statistics Canada
- Maltseva V. (2019) The Concept of Skills Mismatch and the Problem of Measuring Cognitive Skills Mismatch in Cross-National Studies Voprosy Obrazovaniya/ Educational Studies Moscow DOI: 10.17323/1814-9545-2019-3-43-76
- McGowan MA, Andrews D (2015) Labour market mismatch and labourproductivity: evidence from PIAAC data, OECD
- McGuinness S., Pouliakas K., Redmond P. (2018), *How Useful is the Concept of Skills Mismatch*?, IZA Discussion Paper No. 10786,

- Available at SSRN: https://ssrn.com/abstract=2979934
- McGuinness S., Pouliakas K., Redmond P., (2017), *How Useful is the Concept of Skills Mismatch*?, IZA Discussion Paper No. 10786, Available at SSRN: https://ssrn.com/abstract=2979934
- Mercer, Win with empathy, Global talent trends 2020-2021, Marsh and Mclennan Company, New York, February 8, 2021
- Nedelkoska, L.; Quintini, G. (2018). *Automation, skills use and training.* Paris: OECD Publishing. OECD social, employment and migration working papers; No 202.
- OECD (2016), *Getting Skills Right: Assessing and Anticipating Changing Skill Needs*, OECD Publishing, Paris. *http://dx.doi.org/10.1787/9789264252073-en*
- OECD (2017), *Getting Skills Right: Skills for Jobs Indicators*, OECD Publishing, Paris. *http://dx.doi.org/10.1787/9789264277878-en*
- OECD (2017). *Getting Skills Right Getting Skills Right: Skills for Jobs Indicators.*overskilling in Australia and Britain. *The Manchester School*, *78*(3)
- Pellizzari M., Fichen A. (2013) *A New Measure of Skills Mismatch: Theory and Evidence from the Survey of Adult Skills (*PIAAC*).* Paris: OECD
- Pouliakas, K. (2018). The risk of automation in EU labour markets: a skills-requirement approach. In: Hogarth, T. (ed.). *Economy, employment and skills: European, regional and global perspectives in an age of uncertainty.* Rome: Fondazione Giacomo Brodolini. https://www.fondazionebrodolini. it/sites/default/files/pubblicazioni/file/q61_x_web_cor_0.pdf
- Predovic D., Dennis J.L. (2020), Education, aspiration, action: solving the job skills mismatch, European Association for international Education, https://www.eaie.org/blog/solving-job-skills-mismatch.html
- *Production Planning & Control*, *32*(1)
- Prokopowicz, P., Pawlak-Mihułka, J. (2021). Freenovation Predictions Book: 12 prognoz,które pozwolą ci zbudować organizację gotową na przyszłość, Kraków : Freenovation
- Quintini G. (2011), OECD social, employment and migration working papers no. 120 right for the job: over-qualified or under-skilled?, Organisation for Economic Co-operation and

_____

_____

Development, https://dx.doi.org/10.1787/5kg59fcz3tkd-en

- Quintini, G. (2011). "Over-Qualified or Under-Skilled: A Review of Existing Literature", OECD Social, Employment and Migration Working Paper 121.
- Rikala, P., Braun, G., Järvinen, M., Stahre, J., & Hämäläinen, R. (2024). Understanding and measuring skill gaps in Industry 4.0 — A review. *Technological Forecasting and Social Change, 201*, 123206.
- https://doi.org/10.1016/j.techfore.2024.123206
- Robst, J.,(2007) Education and job match: Relatedness of college major and work. Economics of Education Review 26(4)
- Salas-Velasco M., Mapping the (mis)match of university degrees in the graduate labor market, Journal for Labour Market Research,

2021)   55:14 https://doi.org/10.1186/s12651-021-00297-x

- Schwab, K. (2017). The fourth industrial revolution. Currency
- Scottish Government (2008).*Skills Utilization Literature Review*, Glasgow: Scottish Government Social Research
- Skills Australia (2010) *Australian Workforce Futures*, Canberra: DEEWR
- Totah Z., *HR Trends in 2021: Future of Human Resource Management*, Human Resource Information System, https://www.selecthub.com/hris/hr-trends/
- van Vulpen E., Academy od Innovate HR, Top 10 HR trends for the 2021 and beyond, https://www.digitalhrtech.com/hr-trends, available 01.12.2022

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