



Soft skills and their importance in the labour market under the conditions of Industry 5.0

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ABSTRACT

The profound ramifications stemming from a multitude of global events and the ongoing progression of the fourth and fifth industrial revolutions necessitate a broadening of skillsets beyond the mere acquisition of technical and digital proficiencies. The practical, intelligent, responsible, and sustainable utilisation of technologies relies exclusively on human agency. Such employment necessitates a type of cognitive processing that machines find arduous, emphasising the importance of aligning human reasoning with machine intelligence. The significance of digital skills is widely acknowledged within the framework of cultivating suitable sets of employee abilities. Nonetheless, it is imperative to underscore the importance of human skills as they remain irreplaceable by robots. Furthermore, the labour market acknowledges and rewards these skills owing to their capacity to confer flexibility and adaptability, thereby embodying the competing attributes of the future workforce. In light of the prevailing circumstances outlined in Industry 5.0—characterised by an amplified utilisation of technologies and diminished interpersonal interactions resulting from the pervasive impact of the Covid-19 pandemic—this study seeks to provide a theoretical description of the significance of soft skills and their categorisation, while investigating the practical demand for such skills. The dataset used in this study encompasses information pertaining to skill prerequisites extracted from job posts published on a job portal over five years, encompassing 19 000 distinct organisations. The findings of our study revealed that within technologically driven domains, there is a discernible demand for soft skills, such as critical and analytical thinking, problem-solving, communication skills, and creativity with flexibility. Furthermore, our results indicate that individuals must possess balanced proficiency in both soft and digital skills to thrive in a future characterised by technological advancements.

1. Introduction

Recently, a series of notable global events, such as the coronavirus pandemic and conflict in Ukraine, have underscored the susceptibility of organisations and economies; thus, necessitating a prompt adjustment to the altered circumstances and the acclimation to what has been coined as the “new normal” [1,2]. It is increasingly unlikely that world operations will revert to their original trajectories. One of the answers to these challenges can be progressive management techniques based on resilience, sustainability, and

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human-centrism, which are elements of the Industry 5.0 concept [3], and following digitalisation as part of the Industry 4.0 concept [4]. Nevertheless, recognising the importance, an individual within every organisation must adapt to navigate these novel circumstances effectively is crucial. This adaptation primarily entails the acquisition and utilisation of the requisite soft skills necessary to operate within the unique socioeconomic framework of each respective organisation [5].

Industry 5.0, a further industrial revolution, is an improved version of Industry 4.0. The main idea of Industry 4.0 is ‘Smart Manufacturing for The Future’, which increases productivity using innovative technology. In 2011, Industry 4.0 was publicly introduced in Hannover. The integration of advanced technologies, such as virtual and augmented reality, smart factories, ambient intelligence [6], artificial intelligence (AI), big data, and cloud computing, serves as a means to achieve the objective of smart manufacturing, as advocated by the principles outlined in Industry 4.0.

Notwithstanding its transformative potential, Industry 4.0 encounters certain challenges that necessitate resolution, including human costs incurred due to process optimisation and insufficient environmental consciousness [7]. Among the prominent challenges confronted by Industry 4.0 lies the question of effectively managing the role of human resources within the context of the ongoing digital revolution [8]. New technology could escalate labour shortages, reduce human work, and allow organisations to allocate human resources to higher value-added capacities. The digital revolution, characterised by the imperative for dynamic competencies and the acquisition of knowledge and expertise from external sources, holds profound significance and warrants careful consideration of human resource management [9,10].

Therefore, the concept of Industry 5.0 provides a different focus and nests with the Industry 4.0 approach in a broader context. This highlights the importance of research and innovation in supporting the long-term services of an industry. It provides regenerative purposes and directionality for the technological transformation of industrial production, considering humanity and people-planet-prosperity [3,11].

The human-centred approach embodied by Industry 5.0, advocates the advancement and utilisation of emerging technologies, such as the integration of networked sensors, cobots, knowledge and skill transfer between digital systems and their physical counterparts, as well as deep learning and machine learning. These technological advancements aim to compensate for the absence of human involvement in diverse processes. The acknowledged collaboration between machines and humans within the framework of Industry 5.0 emphasises the essential role of the human factor. While humans are present in the process, the Fifth Industrial Revolution will pair humans and machines to utilise human brain power and creativity to increase process efficiency by combining workflows with intelligent systems. Rather than using emergent technology as a starting point and examining its potential to increase efficiency, a human-centric approach places core human needs and interests at the heart of the production process. Instead of asking what we can do with the new technology, we ask what technology we can use [12]. Machines surpass humans in pattern identification, recognition, data processing, and search [13].

Nevertheless, we must ensure that technology is used for social welfare purposes. Accordingly, skills encompassing emotional intelligence, resilience, empathy, creativity, and critical thinking will emerge as crucial proficiencies for cultivating a productive and adept workforce poised to meet future demands. Furthermore, a potential approach to addressing this complex issue is the delineation of roles in human-machine interactions. Humans excel in areas, such as interpersonal interactions, intuition, and complex decision-making. Although humans and machines may arrive at the same answer, their distinct thinking processes result in different paths to reach a conclusion. Tasks that require contextual understanding, situational awareness, and interpretation related to culture, history, and social norms are those where humans are superior to machines. The interpretation of machine-generated answers, presented as probabilities in terms of quality, correctness, magnitude, or significance, requires human judgement. Such a contextual interpretation is intrinsic to soft skills, which involve a level of thinking and contextual understanding that machines are incapable of [14,15].

Moreover, skills and tasks that are not easily replaceable by automation tend to be complemented by automation, whereas social interactions have proven challenging to automate. For instance, our capacity to comprehend and respond to others relies on tacit knowledge, an area where computers still struggle to serve as adequate substitutes, especially in tasks in which programmers lack a complete understanding of all governing rules and variables [16]. The necessity of soft skills creates a demand for employees who possess an appropriate set of skills, thereby constituting a noteworthy challenge for individuals and organisations operating in novel and evolving circumstances.

In their study, Müller et al. [17] identified employee qualifications and acceptance as significant barriers to adopting Industry 4.0 and 5.0 solutions. These barriers include employees’ anxieties, fears, concerns, and a lack of know-how.

In the context of rapidly advancing technology, numerous studies and research endeavours have concentrated on enabling technologies, their utilisation, and the necessity for digital skills that facilitate and support work in highly technological environments. However, only a few publications have directly established the significance of soft skills in such contexts. The human-centric orientation of Industry 5.0, characterised by human-robot collaboration and the demand for a skilled workforce, represents a major challenge, necessitating the identification of soft skills that contribute to the cultivation of a competent and employable workforce capable of functioning not only effectively but also responsibly and sustainably.

In light of the specific conditions discussed within the visions of Industry 5.0, this article aims to provide a theoretical delineation of the role of soft skills and their categorisation, while simultaneously investigating the practical demand for such skills. This study aims to address the following research questions.

(RQ1) What is the theoretical perception of soft skills in the context of Industry 5.0?

(RQ2) How can soft skills be categorised based on theory and practice?

(RQ3) Which categories of soft skills are in high demand in practice?

To achieve these objectives, we conducted an extensive review of the existing literature on Industry 4.0 and 5.0, specifically focusing on references to soft skills and their significance for employers. Additionally, we have carried out an analysis to map the demand for the identified categories of soft skills spanning from 2017 to 2021.

Our paper presents a comprehensive examination of soft skills, drawing upon diverse definitions from the existing literature to foster a comprehensive understanding of this term from multiple perspectives. We discuss the significance of soft skills for employers seeking a competent workforce capable of effectively navigating the challenges arising from transformations in the workplace driven by the ever-increasing utilisation of technology.

Concerning the specific conditions discussed in Industry 5.0 visions, we identified the soft skills that are now addressed as the soft skill gap in the labour market. With the advent of Industry 5.0 approaches, the significance of these soft skills is expected to increase. Therefore, developing a skilled workforce requires identifying key skills to create adequate education and training programs.

This article presents evidence highlighting the strong demand from employers for soft skills compared to digital skills. Moreover, it emphasises the growing recognition of the vital importance of soft skills, as evidenced by the increased demand for these skills in the labour market. The significance of soft skills and the need for their development continue to grow. Focusing on soft skills within the realm of Industry 5.0 is necessary in this emerging era. This study contributes to the advancement of theoretical understanding by providing a deeper comprehension of their significance for individual and organisational success. Furthermore, it illuminates the potential practical implications for organisations, including designing and implementing skill development and training programs, refining recruitment strategies, optimising leadership practices, refining human-machine interactions, and promoting employee well-being initiatives.

2. Materials and methods

As previously mentioned, the escalating dynamic and technical nature of the environment, along with the increasing level of human-machine interaction, highlights the necessity of effectively managing both technology and people. The skills component emphasises the significance of digital skills and soft skills. The envisioned conditions of Industry 5.0 underscore the indispensability of adopting a human-centric perspective, which should be duly acknowledged because of the imperative role played by human factors in highly digitalised lifestyles and work environments. Moreover, global pandemics have stimulated the extensive utilisation of technology within organisations and brought about significant transformations in work and working conditions, where technology plays a crucial role.

Given that social skills are frequently undervalued compared to digital skills, which are often perceived as essential in the digital era, our focus is on assessing the significance of soft skills from employers' perspectives. The primary research design employed in this study was descriptive and aimed to provide a comprehensive overview of the current demand for soft skills among employers.

This study has three research questions. Below is a list, along with the corresponding methodologies employed to address each question (Fig. 1).

2.1. Research question 1 (RQ1): what is the theoretical perception of soft skills in the context of industry 5.0?

To describe the role of soft skills under envisioned conditions of Industry 5.0, we conducted a literature review to assemble relevant information on the topic. 'Preferred Reporting Items for Systematic Reviews and Meta-Analyses' [18] was applied to ensure a systematic approach to the literature review, which consisted of three steps: identification, screening, and inclusion. In the identification phase, the Web of Science database (WoS) was the primary source of information used to answer RQ1 (Part 3). We searched for the terms: 'soft skills' OR 'social skills' AND 'industry ?0' OR 'human-machine coworking' OR 'human-machine cooperation' AND 'labour market'. We have enclosed the terms in quotation marks to find the exact phrase. We used truncation to find Industry 4.0 and Industry 5.0, as some of the ideas within these concepts overlap, and to find the different spellings of labour/labour market in American and British English. Additional terms represent one of the main situational characteristics of the recent industrial revolutions. We selected and evaluated WoS documents as follows: documents with Open Access, publication years of 2016–2022, and English language. We obtained 877 documents from WoS. After selecting articles with more than five citations and reading the titles and abstracts, 279 documents related to the research questions were selected. The selected documents were analysed using the VOSviewer software tool

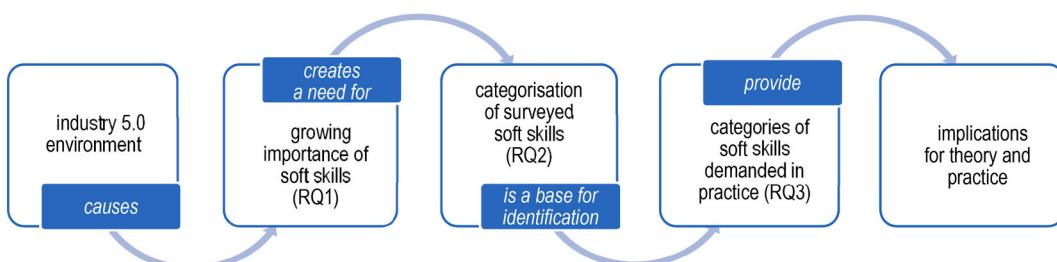


Fig. 1. Research methodology
Source: own creation.

to create a keyword co-occurrence map based on bibliographic data (Fig. 4).

Studies identified via other methods comprised records from books dealing with future skills ($n = 4$), organisations (reports of European Commission, World Economic Forum, World Bank, International Labor Organisation) ($n = 6$), and articles via citation searching ($n = 4$). Fig. 2 shows the flow diagram for applying PRISMA to the literature review.

In the screening phase, 173 records were excluded after reading the titles. In total, 106 records were assessed for eligibility, wherein the eligibility criteria included soft skills, and conditions of Industry 5.0. Soft skills relevant to Industry 5.0 in the labour market context, employers' demands, and requirements for soft skills, were derived from Industry 5.0 conditions. Therefore, the reasons for report exclusion were as follows: 1) soft skills concerning conditions of Industry 5.0 were not mentioned; and 2) there was no relation between the derived soft skills and labour market or employers needed to be mentioned (employability, upskilling, reskilling, and demanded skills from the employer's perspective). After the exclusion of 71 reports, 35 eligible studies were included in the literature review.

2.2. Research question 2 (RQ2): how can soft skills be categorised based on theory and practice?

To address this research question (Section 3.2), an analysis was conducted on the dataset obtained from the Slovak Job Portal, Profesia. sk. The dataset comprises information on the skills demanded by 19 000 organisations over five years, from 2017 to 2021 (Table 1).

The dataset contains 3461 different soft skills, and 12 948 different digital skills required by employers. First, skill terms were obtained from the data provider. We then recoded them to clearly distinguish basic and advanced digital skills and categories of soft skills that we identified as relevant and applicable to a wide range of job positions under the conditions of Industry 5.0, based on our literature review.

2.3. Research question 3 (RQ3): which categories of soft skills are in high demand in practice?

To address this research question (Section 3.3), we analysed the same dataset provided by the Slovak job portal Profesia. sk. The dataset analysed in this study encompasses aggregated data on work positions and the corresponding skills demanded by 19 000 organisations in their job advertisements over five years from 2017 to 2021. After coding the skills, descriptive statistics were used to calculate frequencies. The analysis of the demand for the surveyed skill categories in specific industries involved the use of Pearson's chi-square test to examine the interrelationships between individual industries and job positions. This test is one of the appropriate tests for analysing categorical variables [19–21]. We compared observed values of the nominal variable (such as specific job offers, job offers in different fields, and required skills) within a specified year (an ordinal variable) and the corresponding expected values. The frequencies of individual job offers or skills were processed and tested using contingency tables.

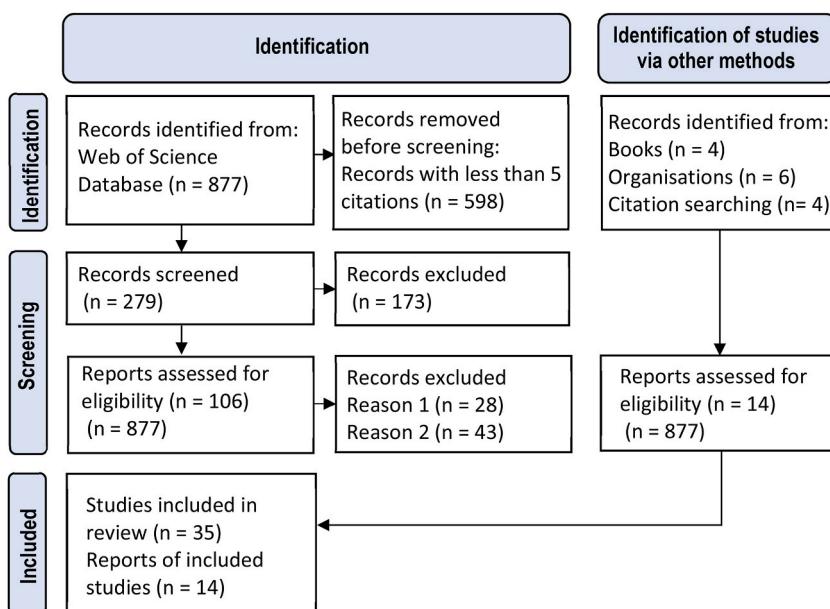


Fig. 2. Result of applying PRISMA to the literature review
Source: own research.

Table 1

Number of organisations in the research sample.

Year	2017	2018	2019	2020	2021
Number of Organisations	18 438	18 150	17 505	15 803	19 716

Source: own research.

3. Results

3.1. Skills in theory

3.1.1. (RQ1) what is the theoretical perception of soft skills in the context of industry 5.0?

One of the challenging issues in exploring soft skills is the difference in the definitions and conceptualisations of soft skills. For instance, multiple definitions of soft skills exist, and they are often used interchangeably with other terms such as 'competence', 'competency', and 'competencies' [22] or are referred to as 'social skills', 'people skills' [23], and 'interpersonal skills' [24]. In our study, soft skills are viewed as the constituent elements of competencies, as illustrated in Fig. 3. This figure shows the theoretical and conceptual models proposed by Marin-Zapata et al. [22]. Developing competencies, including soft skills, is necessary for improving job performance. The development of soft skills depends on the interaction between individual innate traits (i.e. personality and abilities) and contextual factors. In organisational settings, the interaction between soft skills and training programs appears to be vital for enhancing employees' job performance. Within these contextual factors, we focus on changing jobs and work conditions regarding the envisioned conditions of Industry 5.0.

Our perspective stems from the ideas of dynamic capabilities and the resource-based view arising from the knowledge-based view, which proposes that the knowledge base serves as a source of sustainable differentiation and, thus, a competitive advantage [25]. The dynamic capabilities theory suggests that organisations constantly modify their resource-base needs in a dynamic environment [26]. Some primary forms of knowledge in the organisational context reside in individuals [27]. For example, organisations deal simultaneously with tacit and explicit knowledge, where tacit knowledge refers to human acts such as creativity, communication, guess-work, assumptions, education, and learning [28]. Therefore, the role of individuals as antecedents of dynamic capabilities must be considered.

Human intellectual capital determines the building of dynamic capabilities that enable an organisation to adapt to radical technological changes [29]. Nieves and Haller [30] suggest that a higher level of knowledge, skills, and experience gives individuals a more remarkable ability to acquire and apply new and valuable knowledge, thus encouraging the renewal of an organisation's resource base. They propose that human capital can positively influence an organisation's ability to develop dynamic sensing, learning, integration, and coordination capabilities. Sensing is the capacity to detect, interpret, and pursue opportunities in the surrounding environment. Learning involves updating the existing operational capabilities by acquiring new knowledge. Integration encompasses the aptitude to merge personal knowledge with a unit's newly acquired operational capabilities. Coordination entails organising and deploying tasks, resources, and activities within the context of new operational capabilities.

Human abilities related to sensing, learning, integrating, and coordinating activities are also represented by soft skills expected to be in high demand in evolving and technologically vibrant environments under Industry 5.0 [31]. Following a human-centric perspective within Industry 5.0, we focus on the importance of soft skills and explore how their perception in the labour market compares with digital skills. Soft skills are a set of socioemotional capacities and skills that people use in interactions and are crucial to achieving personal and work success [32]. Soft skills are non-technical and non-reliant on abstract reasoning involving interpersonal and intrapersonal abilities to facilitate mastered performance in particular social contexts [33]. Parlamilis and Monnot [34] suggest using the term CORE skills instead of 'soft skills' to clearly declare the value of soft skills. The authors suggest the acronym 'CORE Competence in Organisational and Relational' as a means to effectively distinguish and represent the significance of all non-technical social skills in the workplace. This epitomises the fact that skills contributing to success in modern organisational life are both

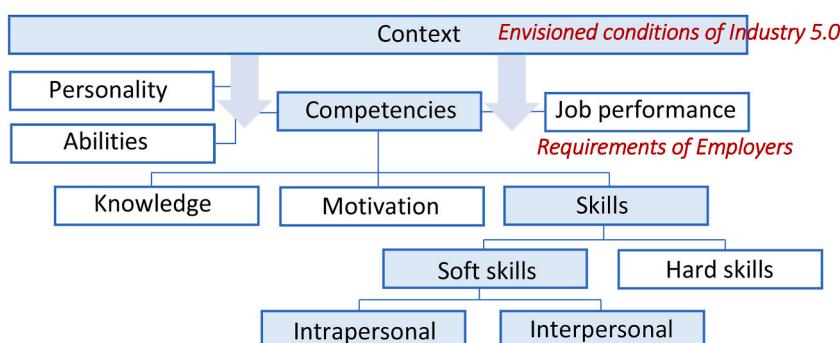


Fig. 3. Conceptual perception of soft skills
Source: adapted from Marin-Zapata, 2022.

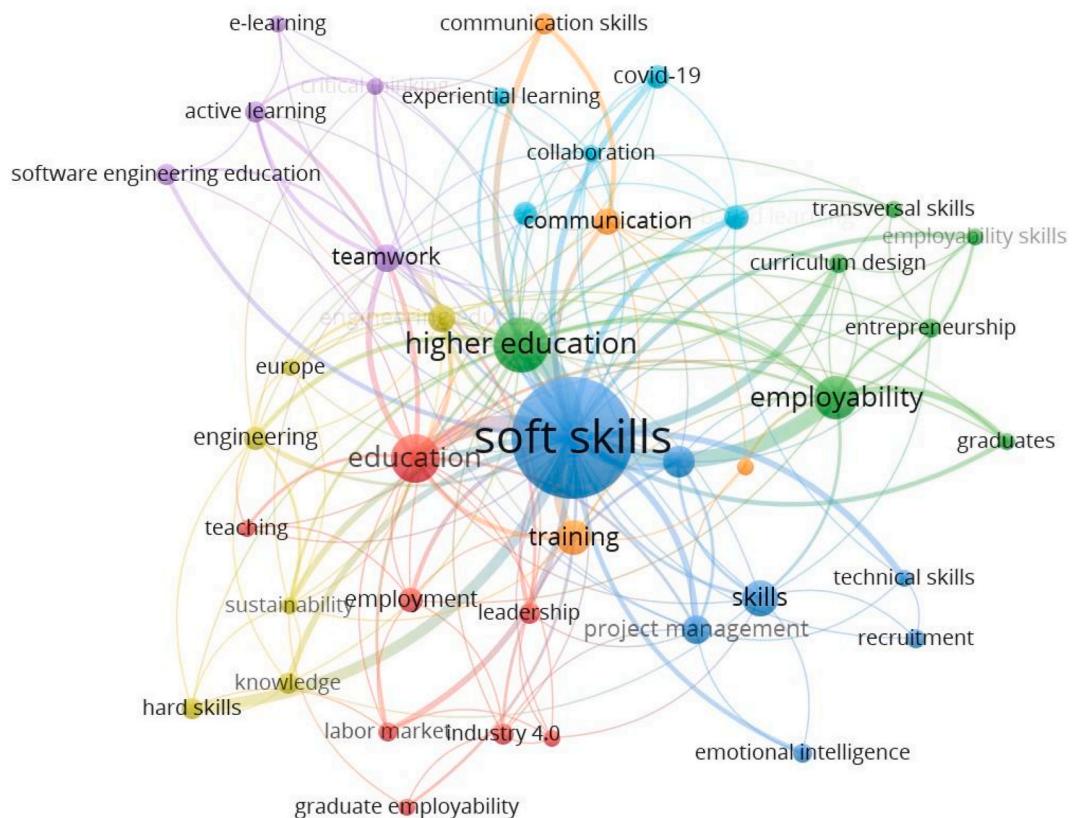


Fig. 4. Visualisation of author keywords co-occurrence network (own research based on the publications indexed in WoS)
Source: own research.

relational and organisational. The authors also envision this new acronym to be on par with the STEM acronym (S = Science, T = Technology, E = Engineering, and M = Math), which is associated with rather difficult technical skills. In ILC.109/Report VI [35], the term ‘STEAM’ adds the fifth soft element, ‘arts’, to the four elements of the original term ‘STEM’, highlighting the importance of creativity and innovation for future jobs.

To answer RQ1, we provided a literature review using bibliographic data from the Web of Science database. We conducted keyword analysis to summarise the thematic flow of the knowledge prevailing among researchers. Using VOSviewer version 1.6.18, we generated a keyword co-occurrence network (Fig. 4). Initially, 1669 keywords from a list of 279 papers. The keywords were limited to at least five occurrences; of the 1669 keywords, 42 met the threshold criteria. The keywords were grouped into seven clusters. Each cluster is represented by a different colour, with a total link strength of 326. The network visualisation of the keyword co-occurrence network generated in VOSviewer shows that ‘soft skills’ is a largely studied concept, followed by ‘education’, ‘higher education’, and ‘employability’. These key topics are discussed in the following sections.

3.1.1.1. Soft skills and education/higher education. The critical role of soft skills is discussed in general or engineering education in Industry 4.0 and is perceived as a lower stage of Industry 5.0 [12,36,37]. Regarding soft skills development, the authors emphasise the role of educational institutions (schools and universities) and learning methods, such as active learning, e-learning, and experiential learning, in developing these skills. Soft skills promoting teamwork, communication, collaboration, and leadership, are among the most common.

Soft skills are commonly recognised as essential components of the skill set required for future employment. Vocational education institutions and universities must anticipate and adapt to the evolving educational needs of society as they transition into a cyber-physical world. Progressive digitalisation in the everyday lives of humans requires new skills from both users and designers in the cyber-physical world [38]. Therefore, the authors discuss the importance of higher education institutions in their acquisition and development [39].

To meet this era’s challenges, graduates must become proficient in 21st-century workplace skills, namely critical thinking, problem-solving, communication, collaboration, creativity, and innovation [40]. 21st-century skills are those that increasingly demand creativity, perseverance, and problem-solving, combined with performing well as part of a team. According to Ref. [41], Pink [42] reminds us of future calls for proactive and creative individuals.

The importance and need for soft skills move from developing these skills within education and graduates’ preparation for

successfully entering the labour market [32] through reskilling and upskilling the workforce to following changing workplace conditions and employers' needs. Educational efforts also play an essential role in mediating the needs of industry and research [43]. Furthermore, the cultivation and enhancement of soft skills play a pivotal role in fostering a proficient workforce capable of establishing positive social connections, facilitating personal and professional growth, and effectively adapting to dynamic changes [44].

3.1.1.2. Soft skills and employability. Another significant observation derived from the network was the correlation between transversal skills and employability. The European Union places great importance on ensuring the employability of a digitally skilled workforce as a vital objective for promoting its growth. In a more digitalised world, new ways of thinking will result in new ideas and changes in the market and society, and people must be able to transition from one job to another [31]. In this context, the authors utilise the term 'transversal skills' to encompass soft skills such as flexibility, adaptability, and interpersonal abilities, enabling individuals to effectively collaborate in teams, communicate efficiently, and solve problems adeptly [45]. These transversal skills [46] are considered to be essential.

The importance of skills is also acknowledged in relation to human-machine interaction within the challenges of Industry 5.0. The extensive array of application areas for robotic systems, for instance, necessitates the development of new multidisciplinary skills in response to growing demand. Rapid technological development underlines the importance of soft skills such as communication, self-motivation, and the willingness to learn [47]. Software production also involves human components that require problem solving, analytical thinking, communication, and cognitive reasoning [48]. The existence and need for any social interaction in society and organisations, even in conditions with intense use of advanced technologies and human-machine interactions, calls for soft skills. Soft skills hold significance because of the inherent nature of reading and responding to signals from others, which occur unconsciously and have evolved in humans over the millennia. Proficiency in social settings involving non-routine interactions lies at the core of human advantage over machines [49].

Robots and automation cannot work without human involvement, and oversight also reflects European Union policies that involve all member states in developing and leveraging public funds to reskill the workforce to avoid job losses caused by digital transformation. Digital European reports highlight the need for significant reskilling and upskilling in more than half of the working European population [50]. Furthermore, digital and soft skills are in high demand in the future.

Advancements in technology and digitalisation are expected to have a profound impact on the labour market. An individual's position within this evolving market significantly influences their employability, which is closely intertwined with their ability to adapt to changing circumstances [51]. Technology is changing the skills being rewarded in the labour market by emphasising the soft skills that robots cannot replace [52]. Table 2 presents the top 10 skills for 2025 [31], accompanied by their categorisation based on the skill classification discussed in our article.

Skills mismatch is an essential dimension of labour market disequilibrium [53] and significantly affects future equilibrium [54]. The discrepancy between employer demand and workforce supply of soft skills became a central issue in Industry 5.0 [37, 43]. This skill gap is already a reality faced by employers. New conditions under Industry 4.0 and 5.0 lead to the emergence of new economic activities, production processes, business models, products, and services, which are expected to cause structural shifts in future work, and consequently, skill demand. As jobs become more interdisciplinary and skills and information become more intensive and innovation-oriented, workers will need a combination of core and specialised technical skills to move across occupations.

The emergence of new jobs in the coming years has addressed the significant skill gap. Consequently, employees must reskill or upskill themselves to manage these gaps [55].

The World Economic Forum estimates that by 2025, 85 million jobs may disappear owing to the division of labour between humans and machines, and 97 million new roles that are more adapted to the new division of labour between humans and machines may emerge. In addition, skill gaps will remain high because of changes in in-demand skills across jobs over the next five years. The top skills employers see rising by 2025 include critical thinking and analysis, problem-solving, active learning, resilience, stress tolerance, and flexibility. Companies estimate that approximately 40% of employees require reskilling for six months or less, and 94% of business leaders expect employees to acquire new skills on the job [31].

Within the context of rapid technological advancements, numerous studies and research efforts have concentrated on enabling technologies, their utilisation, and the imperative for digital skills that enable and facilitate work in a profoundly technological environment. Nevertheless, there is a scarcity of studies explicitly establishing a direct connection between the significance of soft

Table 2
Top 10 skills for 2025 with added surveyed classification of skills.

1.	Analytical thinking and innovation	soft skills
2.	Active learning and learning strategies	soft skills
3.	Complex problem solving	soft skills
4.	Critical thinking and analysis	soft skills
5.	Creativity, originality, and initiative	soft skills
6.	Leadership and social influence	soft skills
7.	Technology use, monitoring, and control	digital skills
8.	Technology design and programming	digital skills
9.	Resilience, stress tolerance, and flexibility	soft skills
10.	Reasoning, problem-solving and ideation	soft skills

Source: adapted from WEF Report, 2020.

skills and such technologically driven environments. The human-centric focus of Industry 5.0, characterised by human-robot collaboration and the requirement for a highly skilled workforce, presents one of the primary challenges. In light of this, it is imperative to identify the soft skills that contribute to the formation of a competent and employable workforce capable of functioning not only effectively, but also responsibly and sustainably, both in their professional and personal lives.

Our literature review revealed that the most frequently mentioned soft skills addressed as highly demanded in the future are communication skills, problem solving, creativity, critical thinking, teamwork, and lifelong learning. The detailed results are presented in Annex A. In the labour market, these skills play a crucial role in the adaptability and flexibility of the workforce. Simultaneously, soft skills as core skills are a valuable part of these skills, regardless of the work position and industry field. From the perspective of Industry 5.0, the importance of digital skills is widely recognised. As a result, there is an increased interest in soft skills, yet there remains a need for comprehensive research on the relevant categories of soft skills. In addition, the reviewed studies highlight future research challenges, emphasising the necessity for a more extensive mapping of soft skills.

3.2. Taxonomy of skills

3.2.1. (RQ2) how can soft skills be categorised based on theory and practice?

To answer RQ2, we recoded the skill terms from the data provider Profesia. sk to distinguish between basic and advanced digital skills and identified categories of soft skills. [Table 3](#) illustrates the taxonomy of the skills studied.

Table 3

Taxonomy of the surveyed skills.

CLUSTER 1	CLUSTER 2 Definition	CLUSTER 3	CLUSTER 3 Definition
SOFT SKILLS	Interpersonal Skills enabling work with others more efficiently	Complex Problem-Solving	Abilities that influence the acquisition and application of knowledge in complex problem-solving.
		Communication Skills	Ability to convey, transfer and receive information, ideas and feelings. Subcategories included Communication—interpersonal, communication via IT.
		Organisational/Managerial Skills	Capacity to manage one's time and planning with others, motivate, develop, and direct people as they work, and identify the best people for the job.
		Teamwork	Ability to effectively and cooperatively work in small groups toward a common goal.
		Leadership Skills	Ability to influence and have an impact on others in the organisation and display energy and leadership.
	Intrapersonal Skills cognitive and self-management skills	Creativity	Ability to think about a task or a problem in a new or different way, and to use the imagination to generate new ideas.
		Analytical and Critical Thinking	Ability to analyse information and use logic to address the issues, identify the strengths and weaknesses of alternative solutions or approaches to problems, and assess performance to make improvements or take corrective action.
		Cope with ambiguity/uncertainty	Ability to handle personal and work-related problems in highly complex and dynamic environments while having incomplete, contradictory, or unclear information and cope with pressure, stress, criticism, setbacks, and personal and work-related problems.
		Value Orientation	Ability to frame interaction with key stakeholders around their desired organisational outcome, being focused on HOW the job is done—correctly, carefully, ethically.
		Flexibility	Ability to quickly adapt to chance and calmly deal with unexpected tasks effectively.
DIGITAL SKILLS	Basic	Initiative and Engagement	Ability to commit and connect to the organisation and take action without being directly instructed by someone else.
		Learning Skills	Ability and willingness to learn in a self-directed and self-initiated manner.
	Advanced	Well-being Focused	Ability to develop self-awareness to recognise the fears and insecurities that change awaken and keep ourselves physically and mentally balanced, thus being able to perceive well-being as a positive outcome within living conditions.
		Taking Responsibility	Ability to accept ownership of one's intentions, actions, decisions, and reactions and the ability to take the consequences for failures and mistakes.
		Emotional Intelligence	Developed capacities used to work with people to achieve goals, mainly being pleasant, cooperative, sensitive to others, easy to get along with, and enjoying working with people.
		Persistence	Ability to stick to a goal long-term and create sustained effort towards a purposeful work.
			Capacity to select the right tools needed to perform tasks, use those tools well and set up and operate technology. (Examples of skills: digital literacy, using, e.g., accounting and finance software, construction management software, digital design, machining, and manufacturing technologies).
			Capacity to use programming to design machines or technological systems determines the cause of operating errors and how to fix them. (Examples of skills: Programming, Artificial Intelligence, WEB development, Computer Hardware & Networking Systems, Cybersecurity security, data science and analysis, Human-Computer Interaction, Scrum/Agile Product Development).

Source: own research.

The dataset contains the 3461 different soft skills required by employers. We clustered them into 16 categories of skills identified in our literature review as relevant to the conditions of Industry 5.0: Problem-solving skills, Communication skills, Organisational/Managerial skills, Teamwork, Leadership skills, Creativity, Analytical and Critical thinking, Value orientation, Flexibility, Initiative and Engagement, Learning skills, Well-being focused, Taking responsibility, Emotional Intelligence, and Persistence.

Problem-solving skills have always been central to adaptation but are more critical during rapid changes. The future will bring unprecedented challenges, and good ideas will be in high demand. Versatility, the ability to think in different ways, consider various options, and see different sides of the problem [47], lies at the heart of problem-solving skills [56]. Problems and conflicts in the future will become more complex, requiring a well-rounded thought of multidisciplinary approaches and collaboration across different areas of endeavour.

Communication skills entail discourse, dialogue, and strategic communication aspects, which serve the individual to communicate successfully and according to the individual situation and context in view of empathy for her/his own and others' needs [56]. It comprises presentation skills, negotiation skills, client communication, and active listening. The ability to communicate via Information Technology (IT) has become highly important as a significant part of communication shifted to written communication via email, chats, or social network comments [57]. However, interpersonal communication is crucial. It is a skill that is highly demanded by employers; it helps convey emotions, use nonverbal communication, and effectively negotiate, persuade, or solve conflicts. Machines, like chatbots, can handle straightforward communication but cannot fully communicate with humans [15].

Organisational/Managerial skills are the capacity to manage one's time and plan with others. With increased remote and hybrid work, fast-paced work, information overload, and never-ending distractions from emails, messages, or family members (when working from home), managing time and activities to complete all work duties on time has become an issue [57].

Teamwork. Collaboratively working in teams helps organisations cope with the problems and challenges stemming from industrial revolutions. It contributes to more creative and effective problem-solving, higher productivity, and better relationships; thus, positively impacting employee satisfaction, motivation, and engagement [57]. The importance of teamwork in the future will increase owing to changes in the conditions in which collaboration will rely more on digital tools. As hybrid and remote working arrangements become more prevalent, involving geographically dispersed team members and diverse teams comprising office workers, remote workers, contractors, and permanent team members, the importance of individuals capable of establishing and nurturing connections among team members and fostering a shared sense of purpose remains crucial. Digital transformation makes managerial work more complex, time-pressured, and collaborative [58].

Leadership skills. In the era of Industry 5.0, endeavours aimed at enhancing engagement, empowerment, and participation hold significant value. Given the human-centric focus of Industry 5.0, transformational and collaborative leadership behaviours are recognised as effective tools [55] to foster positive outcomes. In the era of Industry 5.0, the ability to influence individuals both within and outside an organisation is anticipated to be a highly sought-after skill. Various factors that shape the future of work, such as distributed teams, remote and hybrid work arrangements, complex tasks, and heightened diversity, indicate that leadership skills are crucial not only for individuals in traditional leadership roles but also for those who hold positions involving leading projects, teams, or departments [47,57].

Creativity. Machines can replace repetitive work [11]; however, creative processes remain challenging because of the inherent nature of these processes, in which the outcome is yet to be determined [49]. Work that requires making choices requires creativity and imagination. Creativity is improvisation in which there is limited time to deliberate what is right or wrong. Creativity is a play, which presents a challenge for machines as they lack the capacity for imagination. Creativity serves as a bridge between analytical and intuitive thinking, uniquely enabling minds to operate in both realms. In the future, both precision and errors will be required. This represents an ideal balance. Imperfections make people unique compared with machines. Mistakes allow us to expand our thinking and make discoveries that we were not looking for [15,44]; at the same time, creativity helps us solve problems.

Analytical and Critical Thinking. The ability to think critically will only become more pronounced in the future because we will constantly be forced to navigate through vast amounts of knowledge, and this flood of information shows no sign of abating. When critical thinking becomes inactive, we tend to adhere to certain thoughts or beliefs without understanding the underlying reasons. Consequently, we become more vulnerable to falling due to misinformation and the influence of clickbait [14,56].

Value orientation. Interacting with and utilising new technologies leads to ethical considerations. Organisations require employees to possess ethical awareness, enabling them to discern between right and wrong actions in using technology. This is a challenging issue if we must consider the impact of our decision on various stakeholders while deciding whether technology (e.g. using AI) contributes to welfare and brings value to those organisations, or to what extent technology should be involved in such decisions [15,57].

Flexibility. In future studies, these changes are expected to play more prominent and influential roles. New technologies and rising automation, the rapidly evolving pace of work, regular and vast business disruption, from extreme weather events to a global pandemic—all things individuals and organisations have had to cope with in recent years. The rate of change will likely continue to increase. Moreover, we must develop mental resilience to thrive amid constant change; flexibility and adaptability are key [57]. Farmers will become factory workers, factory workers as knowledge workers, and knowledge workers will, perhaps, become creative problem-solvers. The barn was exchanged for the factory, the factory for the office [15], and the office for any place the employee could work in, ranging from home to street work, satellite centres [59], or coworking centres. In addition to localisation, functional

flexibility has emerged as a sought-after form of flexibility. The diverse range of skills functionally flexible employees possess empowers them to adapt to evolving work conditions and assume various job roles [55].

Initiative and Engagement. Initiative and performance competence refer to an individual's ability to motivate himself/herself and his/her wish to contribute to achievement. Persistence and goal orientation form the motivational bases of performance. A positive self-concept also plays a vital role as it attributes success and failure; thus, performance motivation does not decrease. High intrinsic motivation, initiative, and willingness to perform can continue to prevail in the highly emergent context of action even with newly formulated objectives [56].

Learning skills enable individuals in highly emergent contexts to make the necessary adaptations through learning, anticipate them, and shape them if necessary [55]; for example, in working or living environments or task areas that are subject to change. Continuous learning ensures that individuals' knowledge and skills remain relevant [15,31].

Well-being focused. Technology has helped us in many ways but has not necessarily made life more meaningful. Digitalisation will continue to accelerate, which may lead to an overwhelming sense of malaise due to more complex processes, information overload, and cognitive job demands [60]. Warning signs already exist, and the ability to concentrate diminished. Addictions are becoming more common, and mental illnesses are on the rise. Well-being and self-awareness will be critical skills in the future because they will help us navigate a changing world of unpredictable environments. Self-awareness is imperative for acknowledging the fears and insecurities that arise from change, allowing us to maintain physical and mental equilibrium. This self-awareness empowers us to pursue and experience well-being as a positive outcome of our living conditions [61]. An understanding of well-being and tools for tolerating uncertainty are needed. Believing our capabilities and achieving success in a constantly evolving world are paramount. Rather than succumbing to passive recipients of change, we can view change as an opportunity to enhance our well-being and embrace new endeavours. Consequently, these skills enable individuals to cope with ambiguity/uncertainty; thus, understanding, recognising and handling vagueness, uncertainty, and contradictory information play an important role [56].

Taking responsibility. The evolving work landscape introduces diverse forms of employment and work arrangements, such as remote work that lacks direct supervision and a shift towards contract-based employment instead of traditional full-time positions [31, 35]. As a result, taking responsibility for one's professional work and development is crucial. Employees must also take responsibility for keeping individuals and companies safe in the digital world. This ability contributes to using data and digital technology in a technically, economically, socially, and environmentally responsible manner [57].

Emotional Intelligence. People better equipped with emotional intelligence can form meaningful relationships and become better listeners, leaders, and decision-makers [15]. Despite advancements in our understanding of emotions, human capacity remains indispensable. In a digitally driven world, where information, goods, and services are readily accessible through a mere click or touch of a screen, humans increasingly experience frustration and discomfort due to losing their ability to slow down, solve problems, and

Table 4
Frequency of researched categories of skills.

SKILLS	2017		2018		2019		2020		2021	
	Count	Perc.								
Essential Digital Skills	355 456	18.6%	300 000	16.7%	292 980	16.2%	211 376	15.0%	319 555	14.2%
Advanced Digital Skills	215 502	11.3%	204 058	11.3%	212 490	11.7%	187 323	13.3%	342 051	15.2%
DIGITAL SKILLS	570 958	29.8%	504 058	28.0%	505 470	27.9%	398 699	28.3%	661 606	29.3%
Communication - interpersonal	191 532	10.0%	182 376	10.1%	184 759	10.2%	141 360	10.0%	217 318	9.6%
Analytical and Critical Thinking	139 831	7.3%	140 017	7.8%	142 145	7.9%	115 115	8.2%	186 576	8.3%
Problem-solving	113 692	5.9%	110 491	6.1%	110 605	6.1%	85 167	6.0%	135 552	6.0%
Taking responsibility	94 294	4.9%	99 759	5.5%	99 734	5.5%	78 631	5.6%	125 090	5.5%
Flexibility	99 661	5.2%	93 861	5.2%	90 542	5.0%	66 039	4.7%	98 019	4.3%
Value orientation	69 169	3.6%	71 679	4.0%	70 881	3.9%	59 151	4.2%	88 018	3.9%
Well-being focused	57 827	3.0%	55 829	3.1%	57 171	3.2%	44 354	3.1%	65 113	2.9%
Organisational/Managerial skills	61 845	3.2%	55 137	3.1%	55 962	3.1%	47 233	3.4%	81 437	3.6%
Teamwork	53 725	2.8%	53 574	3.0%	56 084	3.1%	42 987	3.0%	67 306	3.0%
Creativity	47 414	2.5%	44 633	2.5%	42 392	2.3%	35 736	2.5%	62 693	2.8%
Cope with ambiguity/ uncertainty	36 272	1.9%	32 552	1.8%	31 933	1.8%	25 544	1.8%	38 581	1.7%
Learning skills	29 181	1.5%	31 604	1.8%	35 534	2.0%	28 772	2.0%	45 767	2.0%
Initiative and Engagement	30 526	1.6%	27 386	1.5%	27 678	1.5%	20 081	1.4%	30 620	1.4%
Persistence	16 922	0.9%	15 939	0.9%	16 385	0.9%	13 874	1.0%	21 294	0.9%
Emotional Intelligence	2879	0.2%	2583	0.1%	2900	0.2%	2882	0.2%	4311	0.2%
Communication - via IT	1532	0.1%	1043	0.1%	1253	0.1%	1343	0.1%	2960	0.1%
Leadership skills	988	0.1%	711	0.0%	1111	0.1%	993	0.1%	2298	0.1%
SOFT SKILLS	1 047	54.7%	1 019	56.7%	1 027	56.8%	809 262	57.4%	1 272	56.4%
			290	174		069			953	
OTHER SKILLS	294 627	15.4%	274 816	15.3%	277 266	15.3%	201 558	14.3%	320 485	14.2%
TOTAL	1 912 875	100.0%	1 798 048	100.0%	1 809 805	100.0%	1 409 519	100.0%	2 255 044	100.0%

Source: own research and calculations.

navigate [60]. Emotional intelligence can help people calm down, be present in a moment with their thoughts and feelings and take time to solve complex problems [57].

Persistence. In a rapidly evolving and technologically advanced environment, achieving success in work, personal development, and growth necessitates persistence [15,56]. This quality enables individuals to persevere, work towards their goals, and overcome obstacles along the way.

Regarding digital skills, we identified 12 948 different skills required by employers and clustered them into two basic categories: basic and advanced.

Digital skills refer to the ability to use digital media to develop productively, creatively, and critically reflect on their usage and impact on society and work. In the digitally driven future, digital literacy is an essential requirement for individuals to effectively navigate their work, education, and daily lives. Digital skills have become indispensable components of skillsets. We distinguish between two categories of digital skills. **Essential digital skills** enable individuals to utilise everyday software, digital devices, and applications effectively. These skills allow those who possess them to handle data appropriately and communicate and share information via digital tools while remaining digitally safe. **Advanced digital skills** refer to software development, data analysis, and understanding of digital systems. Marr [57] considered the next-level skills necessary to excel in the workplace. Specialised expert engineering and programming positions require a high level of these skills. Nevertheless, a certain level of advanced digital skills is helpful for everyone. Computer programming, AI, and machine learning can be understood without reaching an expert level. We need at least a grasp of how intelligent technologies impact our lives and work as they use data to make more accurate predictions and better decisions.

3.3. Skills in practice

3.3.1. (RQ3) which categories of soft skills are in high demand in practice?

To address RQ3, we analysed a dataset comprising aggregated information on job positions and the skills demanded by employers in their job advertisements over five years, from 2017 to 2021. Our analysis was based solely on aggregate data obtained from a job portal, specifically, a frequency table that provided information on the frequencies of individual skills over the specified years. Data were collected annually, documenting the total number of job offers that included each skill. The number of observations is contingent on the number of skills recorded. In our study, 19 skills were tracked over five years, resulting in a dataset consisting of 95 observations. It is important to note that our data collection did not involve recording individual job offers; instead, we relied on the aggregated data provided for each year. Consequently, our analysis focused primarily on identifying trends and conducting basic statistical tests to elucidate the relationship between skills and temporal evolution.

We analysed two main categories of skills: digital and soft. Employers' demand for these two categories of skills is expressed as the number of times skills appear in advertised job offers on the Profesja Job Portal. Table 4 shows the counts and relative frequencies of soft and digital skills.

Pearson's chi-square test was used to assess the overall association between the demand for job offers featuring specific skills and the corresponding year. The calculated chi-square value of 47 268 at a p-value of less than 0.001 indicates a significant relationship between time and demand for these skills.

The demands for digital and soft skills are illustrated in Figs. 5 and 6, respectively. Fig. 5 shows the number of soft and digital skills required for job advertisements from 2017 to 2021. The overall demand for soft skills is higher than that for digital skills.

The stacked area in Fig. 5 shows the frequency with which employers requested soft and digital skills in their job offers between 2017 and 2021. The number of times soft skills were required fluctuated slightly above one million, while the number of digital skills varied from 505 470 to 570 958. The fall in the sum of soft and digital skills required by employers in 2020 was followed by rapid

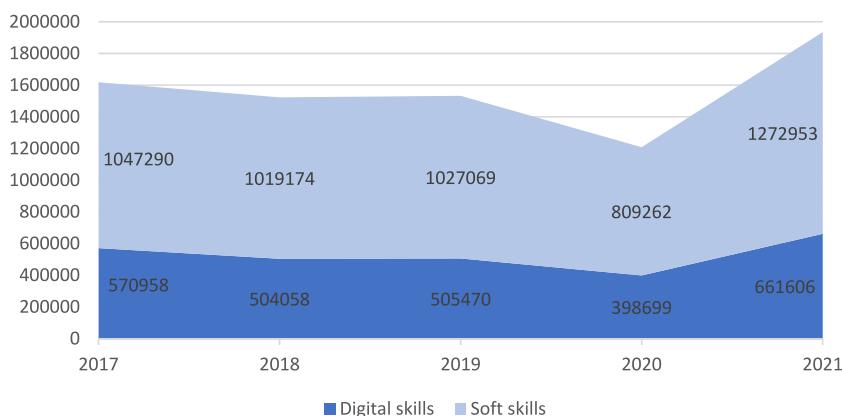


Fig. 5. Demand for soft and digital skills: number of times employers required the skills in job advertisements
Source: own research.

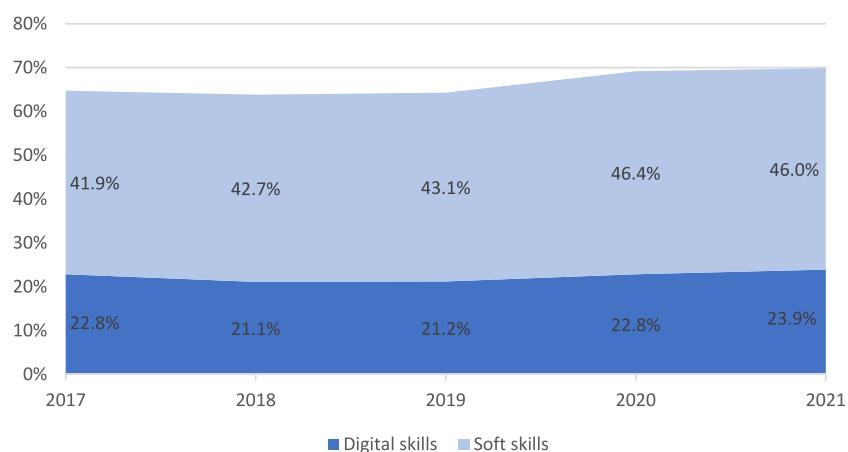


Fig. 6. Comparison of the relative frequency (percentage) in demand for soft and digital skills

Source: own research.

growth in the required soft and digital skills.

The decrease in demand for skills in 2020 is related to fewer organisations offering jobs (Table 1). This is presumably related to the COVID-19 pandemic. We see the possible reasons for an economic downturn, causing many organisations to reduce their workforce and cut back on new hires—many of which were forced to shut down temporarily or permanently—with remote work, social distancing, and sudden intense use of technologies, many organisations paused recruitment to adapt to the new work conditions as uncertainty made them hesitant to make new hires. However, as the pandemic eased, their activities and job opportunities slowly increased in the following years.

We employed Pearson's chi-square test and non-parametric correlation analysis using Kendall's tau to examine the relationship between individual skills (nominal variable) and year (ordinal variable). The results of these tests did not reveal any significant dependence between skill and year. The asymptotic significance (2-sided) for Pearson's chi-square test was 0.992, indicating no significant relationship. Similarly, the Kendall's tau value of 0.004 with an approximate significance of 0.935 suggests no significant

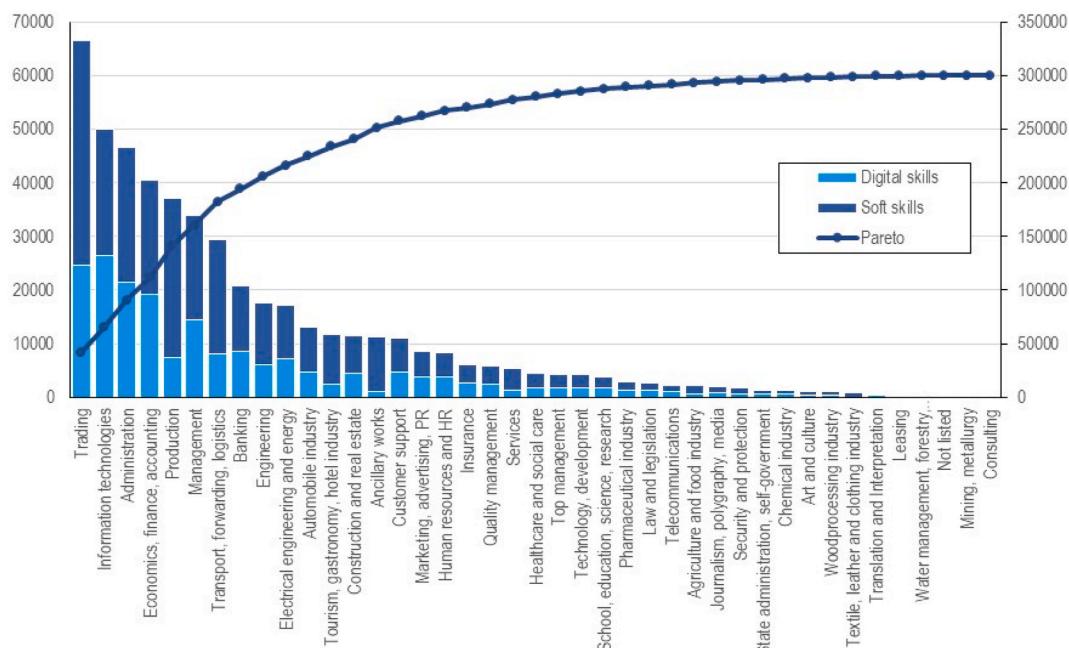


Fig. 7. Employers' skills demand in researched categories of soft and digital skills by industry

Source: own research.

Table 5

Newly appeared job positions in employers' job offers after the Covid-19 pandemic.

Positions	2017	2018	2019	2020	2021	Σ
Frontend programmer	–	–	–	–	506	506
Backend programmer	–	–	–	–	568	568
Fundraiser	–	–	–	2	19	21
E-commerce specialist	–	–	–	10	265	275
Designer of integrated circuits	–	–	22	37	120	179
A Master of Professional Education	–	–	–	13	111	124
Laboratory diagnostician	–	–	–	8	81	89
DevOps Engineer	–	–	–	228	1589	1817

Source: own research.

association between the variables. These findings, with values close to zero, indicated independence between the variables under investigation.

The results of research conducted by Börner et al. [43] showed that demand for technical skills often stimulates subsequent demand for soft skills (e.g. skills such as JAVA programming predict a rise in soft skills, such as teamwork and creativity). We expected increased demand for digital skills due to the intense use of technologies during the social isolation caused by the pandemic. Technology across many job positions allows remote work and fulfilling job duties with the help of cloud computing using applications, such as Zoom or other tools and services, allowing communication, collaboration, and the transfer of a vast amount of generated data. Consequently, with the increase in the demand for digital skills, an increase in the demand for soft skills is expected.

However, we have yet to observe considerable growth in the demand for soft skills. Fig. 6 illustrates the percentage shares of digital and soft skills from 2017 to 2021. The demand for soft and digital skills remains relatively stable without a sharp change.

The demand for soft skills increased slightly, from 42.7% in 2018 and 43.1% in 2019 to 46.4% in 2020 and 46.0% in 2021. Similarly, there has been gentle growth in the demand for digital skills, from 21.1% in 2018 and 21.2% in 2019 to 22.8% in 2020 and 23.9% in 2021. An increase in demand after 2020 might correspond to the end of the pandemic and the consequent growth in organisational activities and seeking of new employees.

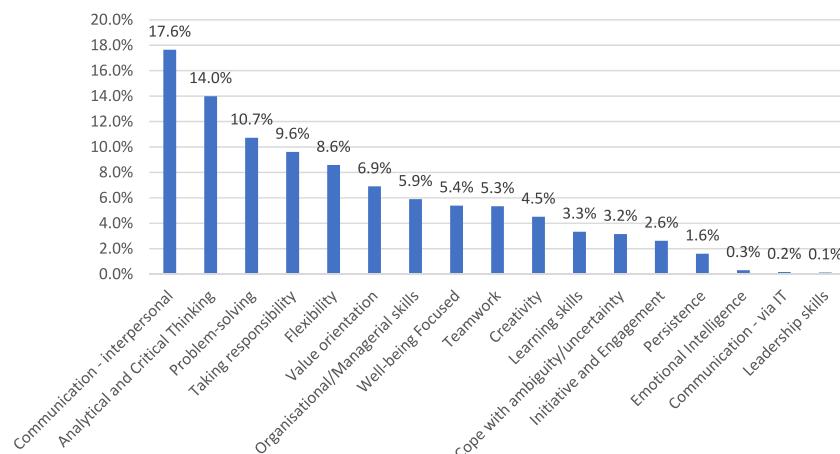
The results demonstrate the importance of soft skills for employers. Therefore, soft skills are in constant high demand.

Analysis of the transformed data did not indicate any significant relationship between individual skills and years. Pearson's chi-square test yielded an asymptotic significance (2-sided) value of 0.998, suggesting no significant relationship. Additionally, Kendall's tau value was -0.004 , with an approximate significance of 0.896, further supporting the absence of a significant association between the variables.

Fig. 7 illustrates employers' job and skill demands in the soft and digital skills research categories by industry.

Overall, job demands were considerably higher in Trading, IT, Administration, Economics, Finance, Accounting, Production, Management and Transport, Forwarding, and Logistics. Considering the perspective of both soft and digital skills, the demand for soft skills is slightly higher than for digital skills. Employers require digital skills to a greater extent only in the amount.

Pearson's chi-squared test was employed to assess the overall dependence between the demand for job offers with specific skills and the year. The calculated chi-square value of 12 015, with a p-value of less than 0.001, indicated a significant relationship between time

**Fig. 8.** Soft skills required by employers in 2017–2021

Source: own research.

Table 6
Demand for particular soft skills.

Area/Soft skill	Analytical and Critical Thinking	Communication - interpersonal	Communication - via IT	Cope with ambiguity/uncertainty	Creativity	Emotional Intelligence	Flexibility
Trading	59 592	214 264	227	29 679	13 056	3170	78 811
Information technologies	91 116	106 062	5489	6067	13 720	393	37 981
Administration	81 279	115 759	184	21 369	6241	3218	44 815
Economics, finance, accounting	91 787	84 758	378	8990	3570	531	27 342
Production	72 750	20 082	127	13 443	78 534	57	36 773
Management	53 940	96 262	891	14 990	9461	1001	40 348
Transport, forwarding, logistics	48 666	35 807	1	17 199	21 133	190	38 016
Banking	41 255	57 837	98	7719	2732	556	13 407
Engineering	35 350	14 599	223	4446	19 783	52	18 346
Electrical engineering and energy	32 279	19 641	641	4786	12 112	44	21 872
Automobile industry	23 945	14 605	176	3696	10 424	113	12 124
Tourism, gastronomy, hotel industry	10 080	26 210	0	9211	4473	306	16 147
Construction and real estate	26 584	19 866	7	6054	8313	160	18 260

Source: own research.

and demand in the analysed industries. To further investigate this relationship, we examined the interrelationships among individual industries. Detailed results can be found in Appendix B, revealing a notable correlation structure among all industries. This finding suggests that the demand for work in each industry develops similarly over time.

The remarkable increase in the use of technologies caused by the pandemic has led to the need for new types of work and positions.

Table 5 displays work positions for which demand appeared and increased after the Covid-19 pandemic. The work positions, namely Frontend programmer, Backend programmer, E-commerce specialist, and DevOps Engineer, fall to the Information technologies sector.

We also focused on identifying the soft skills demanded by employers (Fig. 8). The most preferred soft skills were Interpersonal Communication (17.6%), Analytical and Critical Thinking (14.0%), and Problem-solving (10.7%). On the one hand, employers quite often indicated in their requirements the following soft skills: Taking responsibility (9.6%), Flexibility (8.6%), Value orientation (6.9%), Organisational/Managerial skills (5.9%), Well-being focused (5.4%), and Teamwork (5.3%). On the other hand, the soft skills we identified as essential and which employers rarely mentioned as required skills for offered job positions were Persistence (1.6%), Emotional Intelligence (0.3%), Communication via IT (0.2%), and Leadership skills (0.1%).

Table 6 shows the demand for specific soft skills across the sectors, encompassing 80% of the job offers observed between 2017 and 2021. Interpersonal Communication skills are often required in Trading, IT, Administration, Economics, Finance, Accounting, Management, and Banking. Analytical and critical thinking and problem-solving are often required in these areas. Employers often declare a need for these two skills in production and transport, forwarding, and logistics. Creativity is the most frequently required soft skill in production, whereas employers in other areas require it to a significantly lesser extent. Flexibility refers to the skills employers ask for often in all selected areas, and the highest frequency appears in Trading, Administration, and Management. Leadership skills, identified as the most seldom required skills, have the highest frequency in the area of Management and, surprisingly, in IT.

Fig. 9 illustrates the percentage of soft and digital skills required by employers in 2017, and Fig. 10 shows the percentage of research skills in 2021. Both graphs break down the percentages by category of the researched skills. In addition, the graphs display the order of the most often required soft and digital skills.

Comparing 2017 and 2021, we did not identify significant changes in the order of the most required soft skills. The top five soft skills employers require in 2017 and 2021 (likewise, the years between; 2018–2021) are Interpersonal Communication skills, Analytical and Critical Thinking, Problem-solving, Flexibility, and Taking responsibility. The order of most required soft skills remained relatively stable. However, there has been a shift in the demand for digital skills. In 2017, and in general, by 2021, Essential Digital Skills (18.6%) will be required more than Advanced Digital skills (11.3%). In 2021, the order of the Digital Skills category changed, and employers required more Advanced Digital Skills (15.2%) than Essential Skills (14.2%).

Initiative and Engagement	Leadership skills	Learning skills	Organisational/Managerial skills	Persistence	Problem solving	Taking responsibility	Teamwork	Value orientation	Well-being Focused
34 691	471	30 625	36 459	20 835	71 411	75 587	41 361	62 080	79 565
11 990	2519	24 226	61 201	5773	63 868	23 567	45 044	13 566	5460
15 589	303	18 279	35 710	8719	54 314	42 348	29 981	28 357	32 456
11 587	439	16 461	23 154	6344	42 985	27 468	27 770	20 602	13 184
5456	190	18 791	12 921	3570	45 545	72 212	12 990	45 423	24 501
12 186	1670	8129	51 390	8602	47 021	30 749	29 497	17 098	15 934
6474	61	9324	10 207	2062	38 941	58 095	14 518	47 674	20 938
6496	118	9178	13 634	9641	22 203	14 248	13 397	10 360	19 631
2842	48	7350	6252	1545	28 266	24 679	7642	15 536	4499
4038	75	7058	6366	1724	30 784	20 561	9237	14 119	4467
3001	48	3249	6745	1283	18 609	15 448	5066	10 853	4346
2988	18	5700	4657	2278	17 154	24 397	10 546	14 329	24 342
4930	32	3946	7500	2442	22 243	22 591	7638	12 351	5279

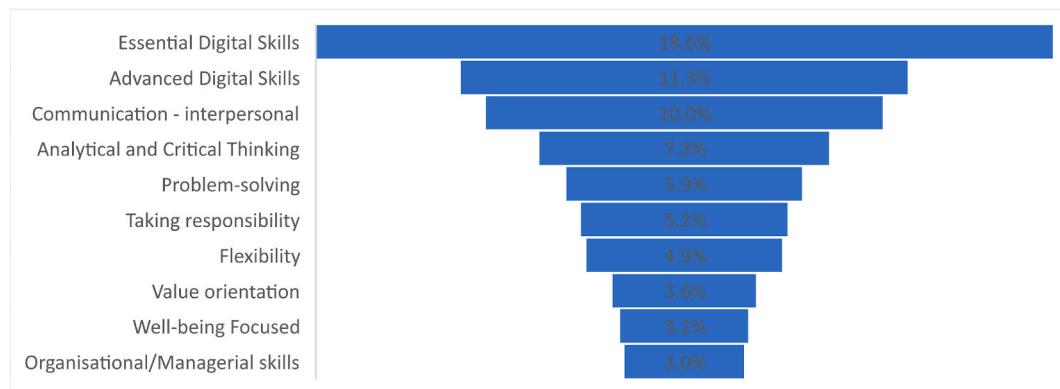


Fig. 9. The most often required soft and digital skills by employers in 2017
Source: own research.

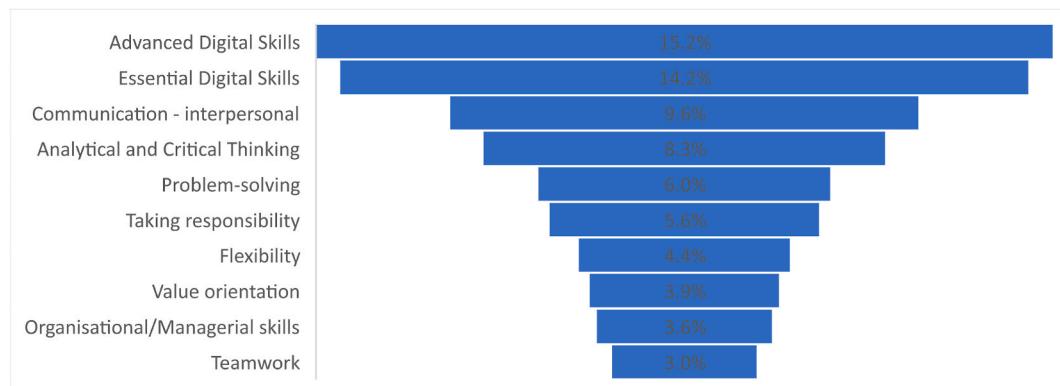


Fig. 10. The most often required soft and digital skills by employers in 2021
Source: own research.

4. Discussion and conclusions

Acknowledging and identifying the skills necessary for future work are key priorities for national and transnational strategies. This study addresses the significance of soft skills by exploring three research questions. In light of prevailing economic and labour market trends, there is a growing emphasis on skills, considering their distinct nature, adaptability, and fluidity in terms of development, enhancement, updating, and transferability. This is in contrast to the broader concept of qualifications, which primarily refers to the formal manifestation of vocational or professional competencies recognised at international, national, and sectoral levels [35].

The soft skills addressed in this study are often considered core skills. Recognising the significance of soft skills for the future enables a deeper understanding of their necessity and serves as motivation to actively pursue their development. The inherent value of these skills lies in their transferability across various occupations, which enables individuals to adapt flexibly to changes and engage in lifelong learning. Employees can respond to changes in demand in the labour market. Our results demonstrate the high demand of employers for soft skills. In anticipation of the technology-driven future characterised by Industry 5.0, we examined the interplay between soft and digital skills, both of which hold significant importance in the future. While digital skills are crucial in the technology-driven world, soft skills possess special characteristics and play distinct roles. Soft skills are usually overlooked in the software industry because the relationship between software development and soft skills is highly complex. Various soft and hard skills are required to solve countless problems related to software development [62]. Our findings revealed that even in technology-focused fields, such as Information Technologies and Engineering or Production and Logistics, employers frequently seek soft skills, such as Critical and Analytical Thinking, Problem-solving, Communication skills, and Creativity with Flexibility. Digital skills have accounted for over 20% of the total skill demand by employers in the past five years.

Considering the extensive use of technology during the Covid-19 pandemic, a significant surge in demand for digital skills was anticipated. However, our analysis revealed a modest growth of only 1% in this category. Our analysis also suggests the possibility of an imminent and substantial increase in demand for advanced digital skills. This demand primarily stems from the emphasis of Industry 5.0 on the collaboration between humans and robots. These skills may be increasingly required in non-technical functional areas where technologies will be intensively used. For instance, with the increase in the use of AI in interviews, AI experts can play an active role in human resources departments. Similarly, data analysts can execute promotional activities within marketing departments can be executed by data analysts [63]. Consequently, employees of these departments need to understand such technology to improve their perception and cognition of its impact on their work.

New trends require a combination of soft and hard skills. Although digital skills are required, especially for expert engineering positions, the activities involve interacting with and applying expertise. With more intelligent technologies, occupations that are related will emerge, for example, to AI-based occupations which only require a few technical skills. Researchers categorise new jobs as trainers, explainers, or sustainable jobs [64]. Our results also identified employers' demands for new work positions. New positions appeared mainly in the software development area; however, one of the newly demanded positions after 2019 was a Master of Professional Education.

As Industry 5.0 becomes fully integrated, the demand for a skilled workforce will increase, accompanied by the growth of new technologies. This necessitates appropriate training programs for both trainees and prospective trainers to ensure they are equipped with the necessary skills and knowledge to thrive in this evolving environment [65].

Current employer demands and emerging trends highlight the importance of recognising the value of soft skills. More than 40% of all skills required by employers are soft skills, which increase slowly. A questionnaire survey by Horváthová et al. [66] confirmed that digital and interpersonal skills are perceived by employers as the most crucial part of their employees' competency model in the future (by 2030). The authors stated that the results showed the dominance of two categories of skills, 'digital and surprisingly interpersonal skills'. Börner et al. [43] showed that the rising demand for 'hard' technical skills is often directly connected to the demand for 'soft' skills. Our study results show that soft skills, represented by interpersonal skills, are constantly in high demand by employers. Together with the discussed soft skills in the envisioned Industry 5.0 conditions, it suggests that a technologically smart future will require employees to be well-equipped with both digital and soft skills. Hence, the increasing significance of both digital and soft skills suggests the need for a concentrated focus on these areas in future research as well as in the realms of labour market demands, research endeavours, and educational initiatives. This comprehensive approach enables a better understanding and promotes soft skills and their development, considering their interconnectedness with evolving labour market needs.

From an educational perspective, soft skills development is crucial for success in both personal and professional lives. Secondary school is an excellent period for students to develop these skills as they prepare for their careers. Soft skills are critical for university students and graduates entering the workforce. Their work values and workplace expectations are studied in generation research by examining a generational cohort known as Generation Z. Generation Z expectations and the importance of soft skills for employability are related to their strong preferences for flexible work arrangements, open communication, fair treatment of all employees [67], and career advancement.

Soft skills, such as adaptability and time management, are essential for managing a flexible work schedule and balancing work and personal responsibilities. The emergence of remote and global teams has made teamwork and collaboration critical. Communication and adaptability are essential for success in these settings. Effective communication proficiency is indispensable in all disciplines. Students must acquire the ability to articulate their thoughts concisely, actively engage in attentive listening, and adapt their communication styles to diverse contexts. Moreover, in the realm of digital communication, including email, instant messaging, and video conferencing, the need for strong communication skills has become more pronounced. As students navigate various scenarios and encounters, they must cultivate adaptability and resilience to confront new circumstances and challenges. In the digital era, the risk of experiencing a sense of disconnection and isolation has increased, making it crucial for students to develop meaningful

connections and relationships.

Emotional intelligence is necessary to build strong relationships and foster a sense of connection between remote and digital environments. Emotional intelligence, empathy, and conflict resolution are essential for creating a positive workplace culture where employees feel valued and supported. The digital era is constantly evolving, and individuals must adapt to new technologically advanced work environments. Creativity and critical thinking are essential for innovation. These skills contribute to the development of new solutions, products, and services that meet the needs of clients and stakeholders.

Soft skills are essential for employability, professional development, and career advancement of students and university graduates. Employers who recognise and value these skills are more likely to attract and retain talent from certain demographic groups. By prioritising soft skills development in secondary schools and universities, the future workforce will be better equipped to meet the demands of the modern labour market and achieve career goals while meeting the expectations of the future generation.

In summary, soft skills are pivotal in enriching interpersonal interactions, fostering effective collaboration and teamwork, promoting adaptability and resilience, driving innovation, establishing solid relationships, and supporting personal and professional development. Moreover, these skills are indispensable for navigating challenges and capitalising on the opportunities presented by the digitalised conditions of Industry 5.0. From a labour market standpoint, soft skills are indispensable for ensuring employability, providing a competitive advantage, future-proofing careers, possessing cross-disciplinary applications, fostering entrepreneurship and leadership, facilitating professional networking, and enhancing career advancement prospects. Possessing vital soft skills with digital skills enhances an individual's marketability and unlocks opportunities within the dynamic labour market.

A primary limitation of our study pertains to the geographical scope of our sample, which was predominantly confined to a specific region. To enhance the generalisability of our findings, it is necessary to expand the study to include an international context, thereby encompassing a broader range of cultural and social influences. By doing so, we can gain a more comprehensive understanding of the phenomenon under investigation and mitigate the potential biases that may arise from a limited geographic focus. Another limitation of our study is the aggregated nature of the data. Due to the inability to access individual-level data, we were unable to employ sophisticated statistical methods that could provide deeper insights and analyses. One potential limitation of our study is the sampling period of the analysed data, which spanned only one year. By utilising denser sampling intervals, such as monthly or quarterly data, we could have potentially improved the accuracy of our predictions regarding the future demand for not only soft and digital skills but also the most prevalent industries. Several advanced statistical procedures are applicable to such cases. Furthermore, it is important to acknowledge that some job offers were relatively generic, with employers selecting from predefined skill categories, even though they might have required additional skills that were not explicitly mentioned or described in detail.

Author contribution statement

Michaela Poláková - analysed and interpreted the data; wrote the paper.

Juliet Horváthová Suleimanová - analysed and interpreted the data; wrote the paper.

Peter Madzík - analysed and interpreted the data; wrote the paper.

Lukáš Copuš - analysed and interpreted the data; wrote the paper.

Ivana Molnárová - contributed reagents, materials, analysis tools or data; wrote the paper.

Jana Polednová - contributed reagents, materials, analysis tools or data; wrote the paper.

Data availability statement

The authors do not have permission to share data.

Declaration of interest's statement

The authors declare no conflict of interest.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Annex A Necessary skills under conditions of Industry 5.0 for better employability

Source	Digital skills generally/basic	Advanced digital skills	Communication skills	Teamwork	Problem-solving	Critical thinking	Creativity	Well-being/Focused/Positive attitude	Learning skills	Adaptability/flexibility	Organisational/Managerial skills	Ethical challenges	Ambiguity/complexity tolerance	Emotional Intelligence	Responsibility	Leadership	Persistence	Initiative/engagement	Industry 5.0	Labour market
12	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	✓	✓	
22																		✓	✓	
23		•	•	•	•	•			•		•							✓	✓	
26	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	✓	✓
27			•	•	•	•			•	•	•							✓	✓	
29				•	•	•									•			✓	✓	
30					•	•	•							•				✓	✓	
31	•	•			•	•			•									✓	✓	
32			•	•	•	•				•	•					•		✓	✓	
33			•	•	•	•	•	•								•		✓	✓	
34	•	•	•	•	•	•		•			•	•						✓	✓	
35					•	•		•			•	•						✓	✓	
36	•		•	•	•	•				•	•					•		✓	✓	
37				•	•	•				•			•					✓	✓	
38			•	•	•	•										•		✓	✓	
39	•		•	•	•	•	•	•	•	•	•	•	•				•	✓	✓	
40	•		•	•	•	•	•	•	•	•	•	•	•					✓	✓	
41					•	•	•			•								✓	✓	
43	•	•			•	•	•											✓	✓	
44			•	•	•	•	•	•										✓	✓	
45				•	•	•	•	•	•	•	•	•				•		✓	✓	
46			•	•	•	•	•	•	•	•	•	•	•	•	•	•		✓	✓	
48	•	•	•	•	•	•	•	•	•	•								✓	✓	
49	•		•	•							•	•					•	✓	✓	
50	•	•	•	•	•	•	•	•	•	•	•	•	•				•	✓	✓	
53																		✓	✓	
54	•	•	•	•	•	•	•	•	•	•	•	•	•					✓	✓	
56			•	•														✓	✓	
58	•		•	•	•	•	•	•	•	•	•	•				•		✓	✓	
59	•	•	•	•	•	•	•	•	•	•	•	•						✓	✓	
	14	9	20	20	18	18	15	12	12	10	8	7	7	6	4	4	3	3		

Annex B Results of examination relationships between individual industries (p-values of Pearson's chi-squared test)

Note: the relationship between two individual industries is statistically significant if the p-value is less than 0.05.

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