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ESG and AI competences in Polish enterprises during the twin transition

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Abstract

Motivation: The dynamically changing needs of the labour market lead to the emergence of new approaches to career development and management. This is due to rapid technological changes and adaptation requirements imposed by the European Union (in particular the Corporate Sustainability Reporting Directive (CSRD) of 16 December 2022). The niche nature of ESG (E – Environment, S – Social Responsibility and G – Corporate Governance) specialisations has created a demand for specialists who are currently lacking in the market. In addition, technological changes and developments in artificial intelligence have accelerated. It is therefore worth determining which skills are currently most in demand.

Aim: This article aims to examine what employee competences in modern technologies and in the area of ESG (E – Environment, S – Social Responsibility and G – Corporate Governance) are needed and critical for companies.

Results: The analysis was conducted on data from a pilot survey based on the author's own questionnaire. The sample was selected using the quota sampling method, taking into account the dominant type of activity according to the Polish Classification of Activities (PKD). The survey was developed based on guidelines from the EU, including the European Sustainability Competence Framework (GreenComp), the European Digital Competence Framework (DigComp), as well as the Global Skills and Competency Framework for a Digital

World. This facilitated the identification of key competences needed in today's turbulent environment. These competences become the basis for choosing a path for upgrading or changing the competences of employees. This is necessary in order to adapt to change and remain competitive on the market. Further research should focus on young adults entering the labour market in order to improve their digital and green skills.

Keywords: competences, ESG, digital transformation, green transformation

JEL: J24, L29, Q56

1. Introduction

In today's turbulent environment, employees who can take on a job and perform tasks in accordance with the requirements of their employer on the one hand, but also in line with their qualifications and competences on the other, play an important role. The educational process is inherently long, and it is not uncommon for employers' competence requirements to change between the start and end of the process. This is where the problem lies – how to attract and retain competent employees. Entrepreneurs emphasise the importance of well-trained staff and aim to hire employees with meta-competences, which ensure the use of key competences for the company and allow for the development of new ones.

The growing interest in the topic of competences is from the increasing instability of the environment for example COVID-19, the war in Ukraine, the progress and dynamic digital and ecological transitions (Zwolińska, 2024).

Bearing in mind the instability of competences, on 5 March 2025 the European Commission officially launched and adopted a package Union of Skills to support the development of skills for high-quality jobs, upskilling and reskilling (European Commission, 2025). Its actions are based on four pillars:

- investing in education and skills development,
- supporting retraining and upskilling processes,
- encouraging educational and professional mobility,
- making the EU more attractive to talent from outside the EU.

Many organisations point to the need to develop skills, such as the Digital Poland Foundation (2019), which conducted research showing *that graduates, however, lack technical experience and soft skills and it will take some time for them to mature as AI experts. In this context, the lack of human capital may be a major constraint in the growth of the Polish AI sector in the long run.*

AI business usage is also accelerating: 78% of organizations reported using AI in 2024, up from 55% the year before. Meanwhile, a growing body of

research confirms that AI boosts productivity and, in most cases, helps narrow skill gaps across the workforce (Artificial Intelligence…, 2025).

According to the OECD report (2018), *societies are changing rapidly and profoundly. A first challenge is environmental: e.g. climate change and the depletion of natural resources require urgent action and adaptation.* A second challenge is economic: e.g. unprecedented innovation in science and technology, especially in bio-technology and artificial intelligence, is raising fundamental questions about what it is to be human.

As stated by the European Commission, there is a synergy effect between digital and green transition, i.e. the 'twin transition', which refers to the simultaneous transition towards more environmentally friendly and digital solutions (Rehman et al., 2023). It should be taken into account that digital technologies can play an important role in reducing pollution and achieving climate neutrality, and that the green transition can lead to greener technologies. This transition will give rise to new products, services, markets and business models. New types of jobs will emerge, requiring skills that we do not yet possess. Therefore, it can be concluded that the competences implied by the megatrends of today's labour market are the development of artificial intelligence and the ESG revolution (which forms the basis for analysing and reporting on sustainable development).

Based on a literature review, it was decided to examine which employee competences in the field of modern technologies and ESG (E – Environment, S – Social responsibility and G – Corporate governance) are necessary and crucial for companies.

Key competences should be understood as those that are important and valuable from the perspective of the company, as they are what allow it to gain a competitive advantage. Due to the limited scope of this article, attention was focused on two types of competences, i.e. those related to modern technologies (understood as advanced tools and solutions, including artificial intelligence, machine learning, Blockchain) and those related to sustainable development, and more specifically ESG. The following research questions were posed:

– Will entrepreneurs train their employees in modern technologies and ESG in the next three years?
– What competences in modern technologies and ESG are most desirable in the surveyed companies?

In addition to a systematic literature review, this article also uses the results of primary research conducted among managers and specialists in companies, taking into account the dominant type of activity according to the Polish Classification of Activities.

The second section of this article provides a literature review on the nature of competences and their division. The third section presents a brief description of the research conducted and specifies where the information on the competences included in the survey questionnaire was obtained. This

is followed by a discussion of the research results (in section four), and references to other authors' studies are included in section five. The article concludes with a summary (section six).

2. Literature review

There is no consensus in the literature on the definition of competence itself, e.g.: Filipowicz (2004), Kwiatkowska-Ciotucha et al. (2021), Hecklau et al. (2016, p. 2) defined competence as *a set of skills, abilities, knowledge, attitudes and motivation that a person needs to effectively cope with tasks and challenges related to work.*

Another definition (Katinienė et al., 2021) indicates that *a competence is a set of demonstrable personal abilities, skills and professional knowledge required to select the necessary operational methods and perform activities/functions/work of a specific type.*

Ali & Qureshi (2021) show that the use of competency frameworks is often hindered because of conceptual ambiguity of methodological rigor in the development of such systems, and psychometric issues.

Such a discrepancy in the definition of the concept of competence may result from, for example, attempts to clarify the concept by scientists specialising in different fields of science. However, a common tripartite division of the concept of competence into knowledge, skills and attitudes (social competences) that enable the effective performance of a task is widely accepted (Mulder, 2014; Wesselink et al., 2010).

In the literature on the subject, attempts have been made to divide competences, with Kannan and Grant (2021) distinguishing between technical skills, methodological skills, social skills and personal skills.

In their publication, Januszko-Szakiel and Korycińska (2022), as part of a typology distinguishing between professional and personal competences, as well as conceptual and operational competences, identified the following:

- cognitive competences – knowledge, i.e. conceptual and professional competences;
- functional competences – skills, i.e. operational and professional competences;
- meta-competences – readiness to learn, i.e. conceptual and personal competences;
- social competences – attitudes, i.e. operational and personal competences.

The divisions of competences result from differences in how the term is understood, the desire to classify competences into general ones that are needed to take up a job, those resulting from the profession, i.e. industry-specific ones, and behavioural competences.

In addition to the concept and division of competences, the authors distinguish between key competences, which represent collective knowledge and learning instruments within an organisation, manifested in the ability to provide additional benefits to customers (Żukowska, 2017).

A noteworthy source of information on key competences is the Future of Jobs Report 2025. This report identifies key competences in 2025 and skills on the rise by 2030 (Table 1).

Managers facing global change are faced with the need to develop and retain employee talent in order to tackle global climate change and organisational sustainability (Brougham & Haar, 2018; Li et al., 2020; Nirino et al., 2020). Therefore, based on a review of the literature, Plum et al. (2017) characterise seven key competences for sustainable development:

1. Systemic thinking competences
2. Utilising diversity and interdisciplinary competences: the ability to shape relationships, detect problems and recognise the validity of other points of view in business decision-making processes, whether in environmental, social and/or economic issues.
3. Foresighted thinking competence – the ability to collectively analyse, assess and create 'images' of the future in which the local and/or short-term decisions have an impact on environmental, social and economic issues
4. Normative competence: the ability to map, apply and reconcile sustainable development values, principles and objectives with internal and external stakeholders, without adopting any norms, but based on the good nature of those involved in sustainable development issues.
5. The ability to actively engage in responsible actions to improve the sustainability of socio-ecological systems
6. Interpersonal competences: the ability to motivate, enable and facilitate cooperation and participatory sustainable development and research
7. Strategic competences: the ability to jointly design projects, implement interventions, transformations and strategies for sustainable development practices.

On the one hand, researchers present a whole range of key competences derived from the literature on the subject, but on the other hand, they conduct empirical research on the importance of competences in the field of sustainable entrepreneurship. Their considerations combine competences 5 and 7 into one competence.

Therefore, the importance of ESG is constantly growing, which is why entrepreneurs recognise the value of investing in human resources with the right competences to effectively implement business processes. These activities allow companies (those that have already developed diversity and inclusion policies) not only to attract talent but also to retain it, thereby contributing

to greater flexibility and creativity in the implementation of processes. This translates into real business success.

It is worth noting that 40% of Polish companies want to invest in developing their employees' ESG skills (Zielona Gospodarka, 2024). Research on ESG-related competences can already be found in the literature, e.g. 'Report on sectoral competences supporting sustainable finance and ESG investments' (Sienkiewicz, Mikołajek-Gocejna et al., 2023).

Cabral and Dhar (2019) showed that environmental competences can be divided into green knowledge, i.e. knowledge of facts, concepts and relationships relating to the natural environment and the entire ecosystem. The authors consider this from the perspective of companies, as it acts as a stimulus to improve environmental scepticism and purchasing intentions, and from the perspective of employees, as it enables them to receive environmental education.

Among the 'deficient' competences identified by Sienkiewicz, Mikołajek-Gocejna et al. (2023) were issues related to new legal regulations, including international ones, on reporting on sustainable development issues.

Symela and Stępnikowski (2021), on the other hand, believe that competence management, especially digital competence management, is becoming one of the key instruments of human resource management in companies in a knowledge-based economy. The authors further note that as a society we face challenges such as personalised universal education, digital illiteracy and technological unemployment.

Bremer & Maertens (2021) compared ten studies on future competences from different countries, using the ESCO classification (European Skills/Competences, Qualifications and Occupations), which contributed to the use of this classification for our own research.

Based on the above, the following hypothesis was adopted: Artificial Intelligence competences are more important for employers than ESG competences.

3. Research methodology

This research was conducted in three stages. The first stage consisted of developing the concept, research assumptions and research tools. The second stage consisted of desktop research and research using an electronic questionnaire supported by telephone. The third stage consisted of empirical research, which was conducted in the fourth quarter of 2024. The method used was Computer-Assisted Web Interview (CAWI). The research tool consisted of 18 substantive questions and 11 questions concerning the characteristics of respondents (enterprises). The survey response rate was 100%, and all forms were completed correctly. The respondents were predominantly

business owners, senior and middle management, accounting for 83% of the total. The remaining respondents held specialist positions in the companies surveyed.

The surveyed group of companies included 100 entities – 50 small and medium-sized enterprises (subgroup 1) and 50 large enterprises (subgroup 2). The most important information about the surveyed companies presented in Table 2. For financial and organisational reasons, the selection for the sample within each subgroup was based on quotas, taking into account the dominant type of activity according to the Polish Classification of Activities. This means that the sample (within each subgroup) reflects the structure of the general population of small, medium-sized and large enterprises operating in Poland, taking into account this particular characteristic. For the purposes of this article, three survey questions were selected and presented in relation to the topic under discussion.

Considering that the aim of this article is to identify which employee competences in the field of modern technologies and ESG are necessary and crucial for companies, three key questions were taken into account for the analysis.

The questions contained in the survey questionnaire concerning competences were developed based on the Future of Jobs Report 2025 World Economic Forum(2025), Artificial Intelligence Index Report (2025), Stanford University Human Centered Artificial Intelligence as well as European and global competence frameworks, i.e.

1. The ESCO classification, which is part of the Europe 2020 strategy and aims to increase mobility across Europe. This classification defines, groups and presents the systemic links between skills, competences, qualifications and occupations relevant to the EU labour market as well as education and training. Competences are divided into four sections, i.e. K – knowledge, L – language skills and language proficiency, S – skills, T – general skills and competences. Section S includes the following skills: S5 – working with computers, T1.3 – working with digital devices and applications, and T6.2 – applying skills and competences related to the environment (ESCO, 2025).
2. DigComp (2022) – The Digital Competence Framework for Citizens (The DigComp 3.0 guidelines) it incorporates recent and emerging digital technological trends and their implications for digital competence, while maintaining the overall framework stability and technology neutrality (European Commission, 2026). Digital competences are defined by five areas of competence: information and data, communication and collaboration, digital content creation, security, and problem solving (Vuorikari et al., 2022).
3. GreenComp (2022) – contains four interrelated areas of competence in the field of sustainable development, namely: 'realising the value of sustain-

able development', 'accepting the complexity of sustainable development', 'visualising a sustainable future' and 'acting for sustainable development' (European Commission, Joint Research Centre, 2022).

4. The Global Skills and Competency Framework for a Digital World (SFIA-9) – in contrast to DigComp, which describes general digital skills, SFIA defines the skills and competences required by professionals who design, develop, implement, and manage data and technology(Burtscher et al., 2024, p. 20–21). As a rule, SFIA (currently in version 9) describes professional skills and competences at seven levels of responsibility, i.e. general attributes, autonomy, influence, dependency, business skills/behavioural factors and knowledge. These levels have been developed to represent increasing knowledge and responsibility in the workplace.

The above competence frameworks provide a kind of roadmap for actions to support the population in the era of dual transformation.

4. Results

As part of the survey, respondents representatives of the surveyed companies, were asked to identify five competences related to technological development and sustainable development (known as the twin transition) that are currently most desirable or crucial in their company (Chart 1). The responses were expressed on a Likert scale (from 1 – not useful to 5 – useful).

The distribution of responses is as follows (number of responses/100 possible responses): Communication and collaboration using digital technologies (59), ability to use digital information and data (50), security: for the protection of devices, content, personal data and privacy in digital environments (43), creation and editing of digital content (41), identification of needs and problems in digital environments (29), solving conceptual problems and problem situations in digital environments (28), concern for the short – and long-term impact of business activities on the environment (27), awareness of the impact of digital technologies and their use on the environment (25), ability to take local conditions into account when solving problems and exploiting opportunities related to sustainable development (20), critical thinking (18), ability to anticipate alternative scenarios for the future of sustainable development (16), knowledge of the principles of responsibility for environmental damage (e.g. the 'polluter pays' principle) (15), ability to create transparent, socially inclusive processes (14), ability to respond quickly, even in the face of uncertainty and unforeseen events (11), ability to synthesise information and data on sustainable development from different disciplines (9).

It can be observed that digital competences are the most important from the perspective of the surveyed companies, followed by those related to sustainable development.

The second question concerned the growing importance of ESG competences, i.e. company activities carried out with care for the environment, society and corporate governance. The responses were expressed on a Likert scale (from 1 – not useful to 5 – useful). From among 11 competences, the respondents identified the following (in over 50% of responses): knowledge of ESG regulations, norms and standards, ability to implement ESG regulations, norms and standards, ability to introduce changes in the field of ESG, knowledge of market trends related to ESG, and building relationships with suppliers in the field of ESG. It should be noted that on 17 June 2025, the Council of Ministers adopted a deregulatory solution concerning ESG (Environmental, Social and Governance) reporting for companies. This obligation for small and medium-sized companies listed on the stock exchange has been postponed from 2027 (for the 2026 financial year) to 2029 (for 2028). Therefore, small and medium-sized companies are not obliged to have employees with these skills.

The above results should be treated as examples of competences that play an important role in building and maintaining human capital in a company.

Taking into account the ongoing digital and green transition, respondents were also asked which training courses are being implemented or planned in the companies surveyed. The responses were expressed on a Likert scale (from 1 – We will not be providing training to 5 – currently being implemented). This question was intended to examine the commitment of companies to the development of employee competences, and the results are as follows (Table 3):

- Sustainable development (ESG) manager training – 46% and ESG carbon footprint calculation training – 45% within the next year.
- Training in carbon footprint reporting and monitoring is being implemented or planned within a year in 31% of companies. Surprisingly, exactly the same number of companies indicated that they do not plan to provide any training in this area.
- 47% are conducting or planning training within a year in the field of artificial intelligence (AI) in practice, data analysis and AI-based conclusion drawing, or AI training for the supply chain.
- Interestingly, the same number (47%) of managers indicated the need for training to prepare for tasks at work after technological changes within the next year.

On the other hand, companies will not train their employees in (equally and above 30% responses): selected AI tools and platforms (e.g. TensorFlow, PyTorch, Azure AI) – 35%, business process automation with AI and RPA (Robotic Process Automation) – 37%; energy-efficient buildings (implementing changes to reduce CO2) – 35%.

According to the survey, respondents indicated digital competences as key for the company, followed by competences related to sustainable devel-

opment. This corresponds to the conclusions of the study by Sienkiewicz, Mikołajek-Gocejna et al. (2023) on self-assessment of competences, which were identified by the respondents as the least developed, i.e. requirements for reporting, conducting ESG risk assessment processes, and obtaining reliable up-to-date information on legal changes in the field of sustainable development. On the other hand, the respondents rated their knowledge of changes in sustainability reporting under the Corporate Sustainability Reporting Directive, sustainability assessment criteria in accordance with the EU Taxonomy, non-financial reporting requirements, and reliable current information on legal changes in the field of ESG sustainability as the lowest among the general competences.

Employees' knowledge and skills should be verified on an ongoing basis and any shortcomings should be addressed through appropriate training. Such training will enable employees to improve their skills on an ongoing basis, as noted by Cabral and Dhar (2019) *Specifically, the findings advocate that managers must nurture an ecosystem of creating green competences in the organisation by providing adequate green training on a regular basis.*

5. Conclusion

The considerations and analyses of studies on the ESG competences and AI competences (the twin transition competences) allowed to achieve the adopted goal.

As noted by the Digital Poland Foundation, 59% of Poles believe that we do not learn enough throughout our lives and are not prepared to retrain. In addition, 67% say that employers do not invest enough in the development and qualifications of their employees.

Nowadays, there is an increasing focus on sustainable development. Although this is not a new concept, it is becoming more prominent due to climate change and growing customer awareness. The topic discussed analyses the presence of 'future skills' with a focus on the increasingly widespread use of artificial intelligence and ESG regulations, which have an impact on the skills required.

- There is no consensus on the use of the term 'competence', as also pointed out by Bratianu, Hadad and Bejinaru in their 2020 study.
- The pace of change in the labour market is very rapid, particularly in areas such as IT and digital technologies, where demand is growing faster than the capacity to provide training.
- Artificial Intelligence competences are more important for employers than ESG competences (which confirmed the hypothesis).
- As noted in the World Economic Forum (2025, p. 73) 65% of employers anticipate challenges in recruiting employees by 2030, so there is

no doubt that the twin transition is leading to changes in employee competency requirements.

The Author is aware of the limitations of her work, which include the adopted methodology and number of companies that took part in the research.

It is necessary to repeat the research presented in this article in order to carry out a comparative analysis and expand the base of analysed studies, either by including additional scientific publication databases or by changing the research criteria. Another area for further research is the study of young adults' competences in the area of twin transition. The author shares the conclusions drawn by Rehman et al. (2023), that there is a lack of research focusing on aspects of the twin transition, as well as a lack of geographical diversity and a narrowing of methodological approaches in the study of the twin transition phenomenon as defined by the EU.

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Appendix

Table 1. Core skills in 2025 and skills on the rise by 2030

Core skills of 2025	Skills of increasing use by 2030
Analytical thinking	AI and big data
Resilience, flexibility and agility	Creative thinking
Curiosity and lifelong learning	Networks and cybersecurity
Leadership and social influence	Resilience, flexibility and agility
Technological literacy	Technological literacy

Source: World Economic Forum, Future of Jobs Survey 2025.

Table 2. Characteristics of the surveyed companies (Subgroup 1 – small and medium, Subgroup 2 – large)

Type of company:	Subgroup 1	Subgroup 2
production	30%	50%
trade	24%	14%
services	46%	36%
Geographical coverage	Subgroup 1	Subgroup 2
domestic	82%	46%
international	18%	42%
global	0%	12%
The predominant type of business activity:	Subgroup 1	Subgroup 2
Industrial processing	30%	50%
construction	12%	2%
trade	24%	14%

Type of company:	Subgroup 1	Subgroup 2
transport and storage	8%	8%
other services	26%	26%
Annual net turnover [EUR]		
<0–2 m>	11%	
(2–10 m>	31%	
(10–50 m>	40%	
(50 m and more)	18%	

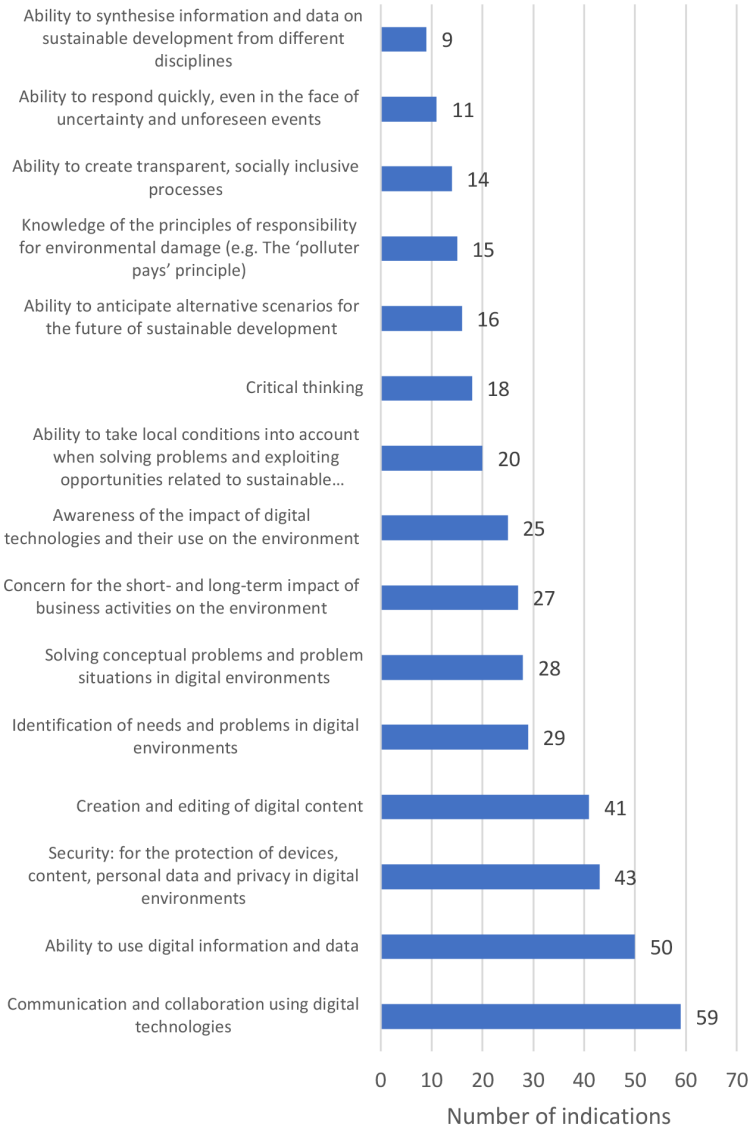
Source: Own preparation

Table 3. Distribution of responses regarding training courses and the time/period of their implementation (in percentages)

Type of training	Currently being implemented	Within six months	Within a year	Within the next three years	We will not be providing training
Training in carbon footprint reporting and monitoring	4	4	23	38	31
Training in ESG carbon footprint calculation	6	7	33	25	29
Training for sustainability managers (ESG)	6	7	32	26	29
Training in sustainable supply chain management	6	13	25	25	31
Artificial intelligence training – AI in practice	10	14	23	28	25
Data analysis and AI-based inference training	3	12	32	27	26
AI training for the supply chain	3	18	26	26	27
Machine learning training for businesses	2	11	24	32	31
Training in selected AI tools and platforms (e.g. TensorFlow, PyTorch, Azure AI)	1	6	23	35	35
Training in business process automation with AI and RPA (Robotic Process Automation)	2	3	24	34	37
Low-carbon economy planning (assumptions, plan creation, monitoring, financing sources)	4	8	26	40	22
Preparation for performing tasks at work after a technology change	3	6	38	30	23
Training in renewable energy sources	3	11	29	26	31
Training in energy-efficient road transport and logistics	3	10	30	28	29
Training in energy-efficient buildings (implementing changes to reduce CO2)	0	5	29	31	35
Training in servicing – for new technologies	1	6	29	31	33
Training in eco-driving	3	3	31	34	29
Training in 'resource efficiency'	3	4	32	29	32

Source: Own preparation.

Chart 1. Competences currently most desirable or crucial in the surveyed companies



Source: Own preparation.