

Lifelong learning in the digital era: How the approach to human capital development is changing

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Abstract. In the context of digital transformation and changes in the labour market, traditional approaches to human capital development are becoming inefficient, meanwhile, continuous updating of knowledge and skills is becoming more relevant as a prerequisite for the competitiveness of employees and organisations. The goal of this study was to identify trends in changes of educational paradigms, analyse the impact of digital technologies on the formation of requirements for employee competencies, as well as to explore best practices for implementing lifelong learning at the individual, organisational, and state levels. To achieve this goal, a comprehensive interdisciplinary approach has been applied, integrating theoretical foundations of lifelong learning, human capital theory and learning psychology with empirical methods, including content analysis, comparative, and systematic analysis of educational strategies and policies. The results of the study suggest a significant impact of digital transformation on the requirements for employee competencies. It has been discovered that nowadays the traditional professional knowledge of an employee is as important as digital literacy, meta-competencies and continuous learning. The study has also revealed significant changes in educational paradigms, with the transition from traditional forms of learning to flexible models focused on individualisation and the use of digital technologies. Online courses, corporate training, micro-qualifications are becoming important components of educational ecosystems. Based on content analysis, it has been found that organisations are currently playing an active role in the development of human capital by investing in training and retraining of their employees. A comparative analysis of the experience of implementing lifelong learning systems in different countries has revealed a number of problems,

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including the digital divide, insufficient motivation for learning and a failure of educational programmes to meet the needs of the labour market. Based on the carried-out study, recommendations for further implementation of lifelong learning to ensure the development of human capital have been made. The practical value of the study is determined by the creation of a theoretical basis for improving educational programmes, corporate training and state policy aimed at supporting lifelong learning in the digital economy

Keywords: competencies; digital literacy; digital transformation; meta-competencies; online learning

● INTRODUCTION

Technological changes, such as automation, artificial intelligence and digitalisation, have radically transformed the labour market. These changes have increased the requirements for flexibility and adaptability of employees, requiring them to constantly update their knowledge and skills. In such conditions, traditional educational models are gradually losing their effectiveness and are currently unable to provide a rapid response to the dynamic needs of the economy, which led to the development of the concept of lifelong learning. This concept has become important for the development of human capital, since continuous learning allows an employee to remain competitive in the labour market, constantly developing new competencies that meet current challenges. For organisations, implementing such a concept means maintaining innovation and productivity, since their employees always have the knowledge in demand and for the economy, lifelong learning is a guarantee of sustainable development and the ability to adapt to global changes, ensuring competitiveness in the global market.

As E. Ostmeier & M. Strobel (2022) and B. Audrin *et al.* (2024) have pointed out, Industry 4.0, characterised by the total implementation of digital technologies, automation and the use of the Internet of Things (IoT), has radically transformed the requirements for employee competencies. In this new industrial landscape, where the physical and digital worlds are closely integrated, traditional skill sets become insufficient. At the same time, a special emphasis should be placed on the development of such competencies as flexibility and critical thinking of an employee, since Industry 4.0 requires not just performers, but thinking specialists capable of innovation and continuous self-improvement. It corresponds to the concept of lifelong learning, which, according to A. Ivashura *et al.* (2022), S. Webb *et al.* (2022) and A. Sandblad (2023), is a key tool for adapting to the rapidly changing social and professional environment. This means that an employee must be prepared for the fact that their profession or skills may change and need to be supplemented throughout the life and not only at the initial stage of their career. This approach ensures personal flexibility and the ability to function successfully in conditions of uncertainty and innovation.

According to the World Economic Forum, more than 50% of employees worldwide will need to be retrained or upskilled by 2027 to meet the demands of new professions that did not exist even ten years ago (Future of jobs report, 2023). Given this, researchers C. Romero & S. Ventura (2020) and L.M. Håkansson *et al.* (2023) emphasised in their works that in the conditions of dynamic changes in the labour market, it has become extremely important to develop in employees the so-called “learning agility”, which is not just the ability to absorb information but a complex characteristic that encompasses the ability to quickly and effectively acquire new knowledge and, most importantly,

transform it into practical application. Thus, “learning agility” goes beyond the traditional understanding of learning, as it involves both the ability of cognitive assimilation and a high level of self-reflection, openness to new experience and willingness to experiment. A highly “learned” employee is not afraid to face unfamiliar tasks, quickly analyses the situation, studies the necessary information and implements the acquired knowledge to achieve certain results. This allows companies to quickly respond to the challenges of the digital age and maintain their competitiveness.

In addition, scientific research in the field of psychology, in particular J. Sweller (2020) emphasised the importance of developing metacognitive skills. This is not just the employee’s ability to learn, but the ability to be aware of and manage learning process. Developed metacognitive skills contribute to effective learning planning, monitoring its progress, evaluating results and adjusting strategies, which is directly related to the successful implementation of self-education models and individual educational trajectories. In this context, the concept of lifelong learning becomes a key element of human capital development strategies, as it ensures constant updating of knowledge and skills, which is the foundation for adapting to rapid changes in the labour market and in society as a whole. Moreover, lifelong learning is the basis for the formation of an inclusive and sustainable knowledge society, where everyone, regardless of age or primary education, has the opportunity to develop their potential throughout their lives.

Thus, the relevance of the chosen topic is stipulated by the challenges faced by modern society, in particular: processes automation, changing requirements for qualifications, the growth of the number of new professions and the disappearance of old ones. All these aspects stipulate the necessity of a systematic study of the digital transformation impact on educational practices and the development of human capital. The goal of this study was to analyse the transformation of the approach to the development of human capital in the context of digitalisation and the spread of continuing education practices. This goal was achieved through the following objectives: to analyse the content of the “human capital” concept and the concept of lifelong learning; to identify key aspects of the digital transformation impact on educational models; to analyse the practice of developing and applying lifelong learning in different countries; to make recommendations for improving approaches to the implementation of lifelong learning in order to develop human capital in the digital era.

● LITERATURE REVIEW

The concept and evolution of lifelong learning

The concept of “lifelong learning” emerged in the second half of the 20th century as a response to the growing need for continuous updating of knowledge and skills.

International organisations such as the Council of Europe, the European Commission and the Organization for Economic Cooperation and Development (the OECD) played a significant role in the development of this concept. The publication of the report on “Education: The hidden treasure” edited by J. Delors *et al.* (1996) was a key milestone. This report laid the foundation for reconsidering the role of education as a continuous process covering all stages of a person’s life. In the following decades, the concept of lifelong learning was further developed in the strategic documents of the European Union and the OECD. According to the OECD (2023) report, lifelong learning is considered as a key to sustainable economic growth, innovation and social inclusion. Within the framework of the modern discourse, the emphasis is shifting from formal education to the integration of non-formal and informal learning, the recognition of the results of individual educational experience and the personalisation of educational trajectories. Thus, as O. Protasenko (2024) pointed out, the evolution of the concept of lifelong learning reflects the transition from a linear model of education to a dynamic, continuous and multi-level system that meets the challenges of the digital economy and the knowledge society.

Human capital theory emerged in economics in the mid-twentieth century as an attempt to explain the contribution of education and professional skills to economic growth. According to K.G. Abraham & J. Mallatt (2022), S. Leoni (2023) and P. Auerbach & F. Green (2024), approaches to the interpretation of human capital have expanded significantly in the context of digitalisation and automation. Modern research emphasises the need to develop soft skills, digital literacy, creativity and the ability to interdisciplinary interaction. Attention is also focused on the concept of learning agility – the ability to quickly adapt and master new things in conditions of uncertainty. Complementing classical economic models, A. Aman-Ullah *et al.* (2022) and L. Arokiasamy *et al.* (2023) considered human capital from the perspective of modern theories as a set of knowledge, skills, abilities, attitudes and motivations that are formed throughout life, rather than within the framework of formal education. This makes lifelong learning not just an element of professional growth, but a strategic resource for sustainable economic development.

The relationship between learning and human capital

Lifelong learning affects directly the development of human capital, providing for a constant updating and expansion of competencies required in the conditions of digital transformation of the labour market. Studies by S. He & H. Yao (2022) and S. Sidenko (2024) proved that a significant part of employees (regardless of their field of activity) needs retraining and advanced training. Moreover, the connection between continuous learning and human capital productivity is confirmed by empirical data. E.S. Knudsen & L.B. Lien (2023) and the OECD (2023) pointed out that countries with a high share of employees involved in continuous learning demonstrate a higher level of employment, innovative activity and social mobility. In the long term, this leads to an increase in the competitiveness of the national economy.

From the perspective of the sociocultural approach developed by F.B. Mecocci *et al.* (2022) and I. Shavkun &

Y. Dybchinska (2022), lifelong learning allows a person to remain an active participant in social interaction and contributes to the development of cognitive and metacognitive skills. Thus, lifelong learning is both an economic category and a mechanism for individual development and social inclusion. Therefore, the concept of lifelong learning is a key paradigm of modern educational discourse, which reflects the transition from a linear model of knowledge acquisition to a continuous, integrative and personalised process of their assimilation throughout life. At the same time, considering lifelong learning from the perspective of human capital theories suggests its fundamental role in the formation and reproduction of a set of knowledge, skills and attitudes that are crucial for both individual and socio-economic development. All these aspects necessitate the study of the lifelong learning impact on approaches to human capital development.

● MATERIALS AND METHODS

A comprehensive interdisciplinary approach, developed in the works of L. Nowell *et al.* (2022) and M.L. Rethlefsen *et al.* (2022), served as a methodological basis of the study, which provided a comprehensive analysis of the studied problem. The content analysis was used to identify key concepts, trends and discursive strategies in the scientific and analytical literature on the issues of lifelong learning and human capital development. The analytical search and review of scientific articles over the past ten years presented in well-known international databases (Scopus, Web of Science, Google Scholar, etc.), as well as books and their chapters, reports and presentations of international organisations (e.g., the OECD, the European Commission,) and large consulting companies, such as McKinsey & Company) were carried out with the help of content analysis. In addition, state strategies for the development of education and human capital were studied within the framework of content analysis. During the content analysis, special attention was paid to looking for information on: new competencies needed in the labour market (e.g., flexibility, critical thinking, digital literacy); existing approaches to organising lifelong learning (online courses, corporate training, etc.); the role of a state, business and each person in lifelong learning; difficulties that arise when implementing lifelong learning. Conclusions on the main trends and differences in views on the studied problem were drawn on the basis of the study results.

The comparative analysis allowed for a comparison of different strategies in the field of education and digital transformation, identification of common features and differences in approaches to the implementation of lifelong learning and human capital development. The comparative analysis included the following: a comparison of national educational strategies in countries with different levels of economic development and digital maturity; a comparison of models of financing and state support for lifelong learning; identification of common features and differences in approaches to the implementation of lifelong learning programmes and human capital development; effectiveness evaluation of specific initiatives and pilot projects.

The system analysis was used to identify the relationships between educational policy, economic transformations and human capital development, as well as to

develop recommendations for the implementation of lifelong learning for the growth of human capital. The analysis was carried out in the following order: identification and assessment of problems in existing education and human capital development systems, hindering the effective implementation of lifelong learning; analysis of hierarchies to determine the levels of management and decision-making in educational systems, as well as their impact on flexibility and adaptability to new requirements. This approach contributed to both understanding the current state and developing comprehensive and substantiated recommendations for the development and implementation of lifelong learning to develop human capital in the digital economy.

Various scientific sources, which provided an in-depth analysis of the problem, served as the empirical basis of the study. Modern scientific publications were used in the course of the empirical study, covering research in the field of lifelong learning, human capital development and the impact of digital transformations, analytical reports of leading international organisations, such as the OECD, which provides comprehensive data and recommendations on education and employment policies, as well as the European Commission, which develops strategies for skills development and support for lifelong learning in the European Union countries. A special attention was paid to current statistical data, in particular Human development reports (2024). The use of these sources made it possible to analyse the current state of the studied problem, as well as to identify key development trends and outline promising areas for further research and practical implementation. Such a comprehensive approach to data collection and analysis ensured the objectivity and validity of the drawn conclusions.

● RESULTS

The impact of digital transformation on competency requirements

Digital transformation, covering all areas of economic and social life, has become a key factor in structural changes in the labour market and in the vocational training system. As G. Nazarova *et al.* (2022) point out, the development of technologies such as artificial intelligence, machine learning and business process automation have created new working conditions and put forward qualitatively different requirements for employee competencies. The modern labour market is under constant transformation, driven by the rapid development of digital technologies. More and more processes in production, logistics, media, education and even healthcare are being automated. As a result, a number of professions have lost their relevance. According to the World Economic Forum forecasts (Future of jobs report, 2023), about 800 million jobs in the world may be

replaced by automated systems by 2030. At the same time, new professions and fields of activity related to data analysis, digital platform management, development and support of AI systems, cybersecurity and digital marketing are being created.

Moreover, as far as the impact of digital transformation on employee competence is concerned, the OECD (2023) report states that lifelong skills are a key to adapting to global trends (digitalisation, population aging, technological change, pandemics) and also emphasises that essential “transversal” skills (critical thinking, teamwork, analytics) are in high demand and significantly increase labour productivity. The recommendations of the EU Council on the need to implement continuous training of employees highlight key competencies, including digital literacy, social communication, flexibility, entrepreneurial skills, etc., which are essential for employees throughout their lives (Council of the European Union, 2018). At the same time, the consulting company McKinsey & Company (2024) in its annual report emphasised the importance of digital transformation of education through the use of microcredits, personalised learning, the use of big data, artificial intelligence for the adaptive transition of employees to new work requirements. The company predicted that digital education could increase global GDP by \$2.7 trillion per year over the next five years. The company also believes that continuing education helps improve a person’s digital, social and cognitive skills, increasing employee competitiveness.

At the same time, flexibility is becoming a new standard in the employment structure. Non-standard forms of work are spreading, e.g. freelance, project employment, remote work and flexitime. These changes require quick adaptation, retraining and effective self-organisation in conditions of uncertainty and constant change. The skills of traditional “hard” professionalism are becoming insufficient, as the abilities for self-renewal, interdisciplinarity and digital mobility come to the forefront. Meanwhile, new realities of work involve the development of a wide range of digital and meta-competencies rather than just the knowledge of specific tools and technologies. These digital competencies are understood as the ability to effectively use digital resources, technologies and data to solve professional tasks. It includes working with information, digital communication, creating digital content, understanding ethical and legal aspects of the digital environment. However, digital skills alone are not enough. Modern employers expect specialists to have meta-competencies, i.e. universal, supra-professional qualities that provide the ability for self-development. Based on the results of content analysis of scientific and analytical literature, the most significant current meta-competencies of an employee have been identified (Table 1).

Table 1. Employee meta-competencies

Meta-competencies	Definition
Critical thinking	Ability to analyse and evaluate information, make informed decisions, resistance to manipulation
Communication skills	Ability to interact in interdisciplinary and intercultural teams, including a digital environment
Adaptability	Flexibility of thinking, readiness for change, stress resistance
Self-organisation skills	Time management, priorities, personal effectiveness in different working conditions
Ability for continuous learning (lifelong learning)	Openness to new knowledge and technologies, ability to learn independently and collaboratively

Source: developed by the authors based on M. Gašior *et al.* (2021), H.B.-G. Chalutz & Y. Cohen (2022)

Thus, the modern model of a competent specialist includes technical qualification, as well as developed personal and social maturity, which contributes to a successful performance in a rapidly changing digital environment. The education system is transforming in accordance with the changing requirements for competencies. Traditional forms of education no longer provide the necessary flexibility and speed of knowledge updating. Instead, new educational formats focused on the digital environment and

individualisation of educational trajectories are actively developing. Digital transformation changes the sphere of employment and the profile of competencies, as well as creates new approaches to learning. The readiness for constant knowledge updating, digital literacy and developed meta-competencies are becoming an integral part of professional success in the 21st century. Key trends in educational formats, identified on the basis of content analysis of relevant literature, are presented in Table 2.

Table 2. New educational formats

Educational formats	Characteristics of the educational format
Online learning	Platforms such as Coursera (n.d.), Udemy (n.d.), edX (n.d.), Stepik (n.d.) and others offer a wide range of courses on relevant topics, ranging from programming to leadership. Online formats provide accessibility to education and the ability to choose the pace and depth of learning independently
Corporate training	Companies are creating internal learning platforms and academies that enable employees to master necessary skills in the context of specific business tasks. It contributes to the continuous development of human capital and adaptation to change
Microcredits and modular learning	Leading universities and platforms offer short-term certificate programmes (nano-degrees, microcredentials), contributing to quick mastering of necessary skills and confirming the qualification
Using artificial intelligence (AI) in education	AI provides for creating personalised learning trajectories, analysing progress, recommending learning materials and accompanying the learner
Gamification and engagement	The introduction of game mechanisms (scores, levels, challenges, competitions) into the educational process, contributes increasing motivation, maintaining attention and improving memorisation

Source: developed by the authors based on N.C. Burbules *et al.* (2020), H.B.-G. Chalutz & Y. Cohen (2022)

Platforms such as Coursera, Udemy, edX, Stepik and others offer a wide range of courses on relevant topics. They provide the possibility of flexible access to knowledge at a time convenient for employees, allowing them to combine learning with work responsibilities. Employee progress can be tracked through built-in assessment systems (tests, assignments, projects) available on these platforms. Based on this data, knowledge gaps can be identified and additional courses or materials can be recommended, adapting training to individual needs. Corporate learning systems can be designed with functionality for tracking progress, including the percentage of course completion, assessment results and feedback from supervisors. Based on the analysis of this data, individual development plans can be created for each employee, offering courses that meet their career goals and business needs. Microcredits and modular learning are ideal for quickly filling specific skill gaps or for obtaining highly specialised knowledge. The progress can be tracked through the skills assessment provided within each module. It makes it possible to accurately determine, which competencies have already been mastered and which require further development, and automatically offer subsequent modules according to individual educational needs.

AI can collect and analyse large amounts of data about an employee's interaction with training content (time spent on tasks, correct answers, typical errors). Based on this analysis, AI can dynamically adapt training materials, change the complexity of tasks, offer additional explanations or exercises and identify employees, requiring additional support, and provide them with automated tips or recommendations. Gamified platforms can automatically track employee progress through a system of scores, achievements and rankings. This creates a sense of competition and encouragement, which motivates further learning. The system can identify "weak spots" in knowledge,

offering additional "challenges" or "missions" aimed at deepening understanding of certain topics and thus tailor training to individual educational needs through interactive game scenarios.

These new educational formats, especially with the integration of AI and analytical tools, provide flexibility in tracking employee progress and individualising their learning, which allows for constant adaptation of educational programmes to labour market requirements and specific company needs, contributing to the continuous development of personnel. Thus, digital transformation changes the employment landscape and competence profile, as well as shapes new approaches to learning. Readiness for constant knowledge updating, digital literacy and developed meta-competencies are becoming an integral part of professional success in the 21st century.

Changing approaches to human capital development in the digital environment

Digital transformation is profoundly affecting the paradigm of human capital development. In the condition of a rapid technological change, accelerated knowledge obsolescence and labour market instability, the classic model of competency formation – through formal education followed by a long period of professional implementation – is losing its effectiveness. It is being replaced by the concept of continuous, flexible and adaptive learning, where apart from educational institutions, employees and organisations are becoming key actors.

One of the main trends is the decrease in the dependence of professional development exclusively on formal educational trajectories. The traditional education system, despite its continuing importance, is not always quick enough to adapt to the rapidly changing requirements of the digital economy. Curriculums are often updated late and a

diploma fails to be a guarantee of compliance with modern labour market challenges. Against this background, the importance of flexible forms of learning, focused on the practical application of knowledge, individual needs and rapid adaptation to changes, is growing. Self-directed learning, informal educational practices (webinars, podcasts, educational channels, online courses, professional communities, etc.) are becoming increasingly popular. Employees independently form and adjust their educational trajectories, based on the tasks, goals and conditions of a specific professional activity. This approach allows them to respond to changes in the professional environment more accurately and promptly and master necessary skills “here and now”.

The digital environment is becoming a catalyst for these processes, providing access to global educational resources, self-diagnostic tools and personalised learning. Mobility, interactivity and accessibility make informal learning an effective alternative to traditional forms of advanced training. In the digital economy, responsibility for the development of human capital is increasingly shifting to the level of organisations. Companies are beginning to play an active role in the formation and maintenance of their employees’ competence, becoming educational agents rather than just employers.

Corporate learning, which is implemented in various formats, has become one of the key tools of this process, ranging from internal trainings and webinars to the creation of full-fledged internal academies and universities. Such structures contribute to quick and flexible adaptation of educational content to the specifics of the organisation’s activities, strategic objectives and requirements of specific roles, contributing to the formation of a single corporate culture and talent retention. The practice of mentoring plays a special role, which strengthens horizontal ties within the organisation, promotes the transfer

of knowledge from experienced specialists to beginners and supports the culture of continuous development of human capital. Mentoring also creates emotional and professional involvement, which is particularly important during hybrid and remote work. Moreover, the strategies of Upskilling (upskilling within the current profession) and Reskilling (complete retraining to transition to a new professional field) are becoming widespread. These approaches are becoming a response to the need for constant updating of competencies caused by technological shifts and changes in business processes. Organisations invest in employee training not only to improve efficiency, but also considering it as a strategic measure to reduce costs connected with hiring new professionals and adapting to technological changes.

Thus, the development of human capital in the digital environment involves abandoning a linear and static model of education in favour of a flexible, multi-level and distributed system in which anyone can become a student, and any environment, including the work environment, can become a learning environment. A comprehensive approach, combining self-directed learning, organisational support and the use of digital technologies, is becoming the basis for sustainable professional growth of human capital in the context of digital transformation.

Experience of different countries in the development and implementation of lifelong learning

Lifelong learning has acquired strategic importance in the context of digital transformation and accelerated obsolescence of professional knowledge. In many countries of the world, this concept has become an integral part of public policy, corporate strategies and educational initiatives. Table 3 provides a comparative analysis of the experience of different countries in the application of lifelong learning.

Table 3. A comparative analysis of lifelong learning in different countries

Country	General characteristics of lifelong learning	The main focus of lifelong learning	Examples of successful lifelong learning models
Azerbaijan	Lifelong learning is a key element of the education system modernisation and the adaptation of the population to digitalisation, changes in the labour market and globalisation. To implement lifelong learning, both formal (universities, technical schools, centres for advanced training) and informal educational platforms (courses, trainings, online programmes) are used for different age and professional groups	Developing formal and informal education, advanced training and digital literacy	Agency for quality assurance in education (TKTA) (n.d.): established to raise educational standards, ensure quality and transparency in the educational environment. One of the agency’s most successful programmes is the teacher professional certification programme Advantage: the programme allows teachers to undergo regular certification and advanced training, which contributes to improving the quality of education and the professional level of personnel Disadvantage: the regions of the country are covered unevenly, which creates inequality in access to learning opportunities, particularly in rural and remote areas
Britain	Continuing education as an integral part of personal development, economy and social mobility. Lifelong learning includes a wide range of opportunities for adult learning: vocational courses, evening and online programmes, as well as on-the-job training	Developing practical and professional skills in demand in the labour market	The open university (n.d.): a state distance learning university founded in 1969. It allows people of all ages and levels of training to: study remotely and at a convenient time; obtain academic degrees or professional certificates; combine studies with work and personal life Advantage: maximum flexibility and accessibility Disadvantage: lack of live interaction and practice

Table 3, Continued

Country	General characteristics of lifelong learning	The main focus of lifelong learning	Examples of successful lifelong learning models
Germany	Dual training system, which includes theoretical education and practical onsite training directly at enterprises. Advanced training and professional retraining programmes, financed by the Federal Employment Agency, are available for the adult population	Supporting the mobility of professionals and preventing professional burnout	Weiterbildungsprogramm (WBS Training, n.d.): a set of public and private vocational training and advanced training programmes focused on the specific needs of regional and industry labour markets Advantage: close connection with the labour market Disadvantage: unequal access (e.g. workers with low level of education, migrants or workers in precarious employment are less likely to participate in training)
USA	The concept of lifelong learning is implemented mainly through the educational services market and private initiatives. A developed network of community colleges, online universities and corporate academies provides for acquiring professional skills in a short time	Investing in employee Upskilling and Reskilling programmes	Community colleges in the United States (n.d.): the programme provides opportunities for adults to gain practical knowledge, change careers or upgrade skills; programmes are tailored to busy people (evening/online classes); often provides practice-oriented programmes Advantage: accessibility and practical orientation Disadvantage: limited academic and career prospects
Ukraine	The initial stage of the lifelong learning development. Along with supporting the traditional higher education system, the state is developing digital educational platforms and implementing projects to train adults, including temporarily displaced persons and people with limited access to the labour market	Developing digital literacy and self-employment skills	Diia. Education (n.d.): aims to increase the digital literacy of the population; provides access to free online courses on the basics of digital security, the use of e-government services, digital hygiene and other issues Advantage: accessibility of digital learning to a wide audience Disadvantage: limited depth and academic content
Finland	The most integrated approach to building a lifelong learning ecosystem. The country has a modular education system, which allows adults to increase their qualifications flexibly at a convenient pace. State educational institutions cooperate closely with employers and programmes are funded from budgetary and private sources	Making digital skills training available to all age groups	Digivisio 2030 programme (n.d.): a national project that aims to create a digital platform, uniting all educational institutions; provides access to courses from any university or college in Finland; makes learning flexible and personalised Advantage: personalised and flexible learning Disadvantage: digital divide and technological barriers
France	Ensuring professional mobility, advanced training and adaptation of citizens to changes in the labour market. Educational trajectories are created individually, taking into account the employee's needs. Lifelong learning is supported by the state, employers and social partners, which ensures accessibility and effectiveness	Developing professional competencies and ensuring equal access to educational opportunities for all citizens throughout their lives	Compte Personnel de Formation (n.d.) system: allows every employee and job applicant to accumulate training hours upon entering the workforce and use them to complete certified educational programmes Advantage: flexibility and personalisation (employees choose independently the direction, format and training provider, based on their own professional goals) Disadvantage: limited awareness of employees about the opportunities provided by CPF, which reduces the reach of the target audience and the efficiency of resource use
South Korea	Introduction of digital technologies into educational processes. The state invests in the development of online platforms and encourages learning via smartphones, which makes education more accessible to the population	Priority for technological specialties and IT competencies, including training middle-aged professionals for the transition to the digital economy	National online platform K-MOOC (National Institute for Lifelong Education, n.d.): covers a wide range of disciplines and is aimed at adult learners. Its feature is the adaptation of courses to mobile devices and the use of personalisation technologies Advantage: broad and equal access to high-quality education Disadvantage: low course completion rate

Source: developed by the authors based on S. Benasso *et al.* (2022), H. Hinzen *et al.* (2022), A. Kuzior *et al.* (2023), Future of jobs report (2023), Human development reports (2024), I. Spivak *et al.* (2024)

The presented results of the comparative analysis made it possible to conclude that, despite successful practices, lifelong learning faces a number of barriers. In particular, the development of lifelong learning is hindered by the low level of digital literacy among employees over the age of fifty and in rural areas, which limits access to modern learning formats and requires basic digital training. There is also unequal access to educational resources due to social, economic and territorial factors, and in some countries there is a lack of infrastructure for large-scale online learning; in addition, some employees do not have a sufficient motivation to learn due to a lack of time, resources or incentives, and educational programmes often fail to meet the labour market requirements, do not provide the appropriate level of practical training and are not accompanied by certification recognised by employers. However, despite the existing barriers, there is a sufficient number of positive results of implementing lifelong learning systems in the company activities.

One example is Siemens, a global technology conglomerate known for its investment in employee development (Siemens UA, n.d.). The company actively uses dual education programmes and its own internal academies to upgrade the skills of engineers, technicians and managers. Siemens supports lifelong learning through various formats, including online courses, seminars and practical training to ensure employees' skills compliance with the latest technological advances. Another example is Google, a leader in implementing innovative approaches to learning, offering a wide range of internal programmes known as "Googler-to-Googler" (g2g), where employees share their knowledge and skills. Moreover, Google actively uses online platforms such as Coursera (n.d.) to provide microcredits that allow people to quickly acquire in-demand skills in the areas of IT support, data analysis, project management and UX design. It allows the company to constantly update the competencies of its employees and attract new talent.

Another example is the French telecommunications company Orange (n.d.), which implements the development of digital skills of its employees. The company actively uses the *Compte Personnel de Formation* (n.d.) system and has its own system, offering a wide range of training programmes adapted to the needs of the company and the individual career trajectories of employees. The company uses various formats, including blended learning, virtual reality and gamification to make training more interactive and effective. Another example is the Swedish company Spotify (n.d.), which encourages a culture of continuous learning and development. The company supports its employees in taking external courses (Coursera, Udemy, edX, etc.), attending conferences and participating in internal hackathons and workshops. Spotify also provides access to online resources and encourages knowledge sharing between teams, which contributes to rapid adaptation to changes in technology and market conditions.

Recommendations for implementing lifelong learning for the growth and improvement of human capital

Companies are actively integrating lifelong learning into their HR development strategies, realising that traditional approaches to learning are losing their effectiveness. Companies are focusing on flexible learning models that focus

on individualisation and the use of digital technologies. Thus, companies are taking an active role in the formation of human capital by investing in training and retraining of their employees. The introduction of continuous education systems is causing changes in the leadership style of companies. In the context of digital transformation, leadership is transforming from directive to coaching, where managers become mentors, helping employees identify their educational needs and directing them to appropriate training programmes. The development of "learnability" has become a top priority. In addition, leadership is focused on encouraging employees to self-reflection, openness to new experiences and willingness to experiment, being the key aspects of "learnability".

To support employees' digital transformation, management approaches are also needed to effectively overcome barriers such as the digital divide, low motivation and the incompatibility of educational programmes with labour market needs. It includes personalising learning through the use of AI to adapt learning trajectories to the individual needs of every employee, as well as analysing knowledge gaps and recommending relevant courses. It is important to stimulate motivation through the implementation of effective mechanisms, such as gamification, incentive systems and achievements recognition, which increase employee engagement in learning. In addition, it is necessary to ensure a close connection of educational programmes with current labour market requirements for employees to receive in-demand skills. The formation of a culture of continuous learning is vital, where learning becomes an integral part of the work process and career growth rather than an additional burden.

Thus, the successful implementation of lifelong learning requires a comprehensive approach that combines state policy, employer engagement and personal responsibility of employees. The experience of applying lifelong learning systems in different countries, as well as examples of its successful application in the world's leading companies, suggest that effective improvement of the human capital quality through the application of lifelong learning models is achieved by coordinating the efforts of all parties involved, investing in digital infrastructure and creating a culture of permanent development of human capital. Modern socio-economic challenges, including digital transformation and accelerated aging of professions, emphasise the need for active development of lifelong learning in order to develop human capital. Based on the results of the content analysis of literary sources presented in the paper, as well as a comparative analysis of lifelong learning in different countries of the world, the conclusion was made that a comprehensive approach, covering technological, institutional and personal aspects, is needed for its effective development and implementation.

Based on the systematic analysis of the obtained results, technological methods were proposed to contribute to the further development and implementation of lifelong learning. They include the development of a flexible educational infrastructure for adapting training to the needs of specific groups of workers and the labour market, providing access to online courses, modular programmes and micro-qualification opportunities. It is also important to ensure the recognition of non-formal and informal learning,

including experience acquired outside formal educational institutions. The increase in digital inclusion is an essential aspect, suggesting the availability of digital technologies and skills necessary for full participation in learning for all segments of the population.

It is worth mentioning that the development and implementation of lifelong learning requires institutional participation. The systematic analysis of the obtained results made it possible to identify the main participants of this process. The state, as a key participant, must provide a regulatory framework, stable financing and the creation of a holistic educational ecosystem that will encourage the participation of all employees in lifelong learning. The business plays an important role by investing in personnel development and creating a culture of continuous learning in the workplace. The individual, in turn, is responsible for his own development, which includes self-direction in learning and mastering digital literacy for the effective use of available educational resources.

Personal aspects should be based on increasing the involvement of employees in lifelong learning, which can be achieved through the use of multi-level motivational mechanisms. They include career growth opportunities, which directly depend on the level of qualification and readiness of the employee to master new competencies. Companies are increasingly linking career advancement and salary increases with employee participation in training programmes and advanced training courses, which forms a stable internal motivation for continuous learning among employees. Obtaining digital certificates confirming the successful completion of courses or training modules is another important incentive. Such certificates have genuine value in the labour market, especially if issued by recognised educational platforms or accredited institutions and can be used when looking for a job, applying for a promotion or participating in grant competitions. Tax benefits for those who invest in their own education are also an effective mechanism.

For example, a number of countries, such as Germany, France, Switzerland, the USA and Canada, have been using mechanisms that allow for partial compensation of training costs through “tax deductions” or “partial refund of course fees”, which lowers the financial barrier and makes educational investments more accessible to employees. Finally, gamification and the use of interactive formats contribute to both a more active participation in training and better memorisation and application of the acquired knowledge. Gamification techniques enhance employees’ intrinsic motivation, make the learning process less formal and psychologically comfortable, especially for adults who may experience stress from the traditional academic approach, and interactivity contributes to increased cognitive interest, improved information assimilation and development of practical skills through active participation. Taken together, the application of the proposed methods in the development and implementation of lifelong learning will contribute to achieving the main goal – the growth and improvement of human capital in the era of digital transformation.

● DISCUSSION

The obtained results indicated a paradigm shift from traditional educational models to flexible, individualised and

technologically integrated formats. Key trends, such as the spread of online learning, the development of corporate academies, the use of micro-qualifications, the integration of artificial intelligence and gamification, have not only changed teaching methods but also radically influenced organisational management, personnel development strategies, and leadership styles. These findings have been widely confirmed and refined in modern scientific research by the global community.

The findings on the dominant role of online learning and digital platforms in ensuring the accessibility and flexibility of education are fully consistent with the findings of many researchers. For example, R. Huang *et al.* (2020) in their paper on the transformation of education under the influence of digital technologies emphasised that the COVID-19 pandemic has accelerated the transition to online formats, revealing their ability to overcome geographical and time constraints, which is critical for continuous professional development. The paper also considered the growing role of massive open online courses (MOOCs) and specialised platforms. S. Sharma & R. Rathore (2023) analysed the effectiveness of online learning in the corporate sector, confirming that it significantly improves the level of knowledge and productivity of employees, especially when the content is interactive and adaptive. These works fully confirmed the findings on the importance of online formats in the present research.

The conclusion about the growing importance of corporate learning and the creation of internal academies as a mechanism for adapting to changes in the labour market also resonates with global trends. K. Andriushchenko *et al.* (2022) studied the impact of corporate universities on organisational innovation and competitiveness and revealed their key role in the formation of unique competencies focused on specific business needs. This work confirmed the conclusion that such academies contribute to the continuous development of human capital. B. Mustafa & S. Lleshi (2024), having analysed the impact of investment in training on company productivity, also pointed out that internal training programmes that are directly related to business goals are more effective for improving skills and retaining talent.

The assumption in the paper about the growing popularity of micro-qualifications as a means of rapid acquisition and validation of skills was confirmed by T. Semigina & Yu. Rashkevych (2023). The authors studied how micro-certifications are becoming a response to the market need for flexible and targeted training, allowing employees to quickly adapt to new technological requirements without the need to complete lengthy programmes. The authors pointed out that micro-qualifications play a key role in creating an adaptive workforce. J.P. Roque (2023) also studied the benefits of modular learning in the context of professional development, having emphasised its ability to provide “on-demand learning” and personalised learning trajectories. The authors’ views are relevant, as they confirmed the effectiveness of this approach for a quick response to labour market dynamics.

The implementation of AI for personalising learning trajectories, analysing progress and recommending materials has become one of the most relevant research areas. M.J.K.O. Jian (2023), C. Halkiopoulou & E. Gkintoni (2024)

explored the potential of AI in transforming the educational process, emphasising its ability to adapt content to individual learning styles, optimise information delivery and provide personalised feedback. C. Romero & S. Ventura (2020) also demonstrated in their study how AI systems can identify knowledge gaps, predict performance and automatically adjust curricula, which is fully consistent with this paper findings. The above-mentioned studies also confirmed the fact that AI is a driving force for individualising learning.

The thesis of gamification effectiveness in increasing motivation and engagement in the learning process is also supported by many studies. M. Li *et al.* (2023) conducted the analysis of gamification impact on learning, having confirmed a significant increase in employee engagement, performance and satisfaction with learning. The study emphasised that the correct implementation of game elements can transform the educational experience. C. Baah *et al.* (2024) also investigated the impact of gamification on learning motivation in a corporate environment, having found a positive relationship between gamified platforms and employee engagement in learning, which was consistent with this paper findings on the significant potential of gamification to increase learning efficiency.

Regarding the evolution of leadership styles from directive to coaching and the formation of a culture of continuous learning, the findings are supported by I.M. Mogaji & H. Dimingu (2024), who emphasised the importance of organisational culture in the context of human capital development. The authors pointed out that a culture, encouraging learning, experimentation and openness to change is necessary for successful digital transformation. S. Sidenko (2024) also emphasised that modern leaders should be mentors, supporting the continuous development of their teams, rather than just managers. The study confirmed the thesis that leadership should promote self-reflection and “learnability” of employees.

Although the research results have been widely supported in the scientific literature, it is worth mentioning that some aspects have been found to differ or require further elaboration. For example, despite the overall positive evaluation, some papers, such as A. Morales-Vargas *et al.* (2023), have pointed out challenges related to the quality of online content and the need to ensure a high level of interaction to maintain motivation. Moreover, while the paper emphasises the importance of personalisation, studies, such as N. Chen *et al.* (2023), have proposed more in-depth methodologies for evaluating the effectiveness of personalised learning based on big data and machine learning, which could be the subject of further research. The present research focused on general trends, while some papers refined specific implementation models and impact measurements.

Thus, the results of the study are consistent with the general scientific trends in the field of continuing education and its impact on organisational management. The scientists’ findings confirmed the significance of the chosen topic and the need for further research to address the challenges associated with the digital divide, motivation and adaptation of educational programmes to changes in the labour market. The interest of the global scientific community in this topic suggests its importance for future development of human capital and organisations.

● CONCLUSIONS

The study analysed the transformational changes in approaches to human capital development driven by digitalisation, which requires continuous learning. The obtained results suggest that traditional educational models are losing their relevance, giving way to flexible, individualised and technological formats. The main drivers of this transformation include the spread of online learning, the active development of corporate academies, the increasing use of micro-qualifications, the integration of AI into educational processes and the introduction of gamification elements to increase engagement. These new educational formats have not only changed the ways of acquiring knowledge but also influenced organisational management, personnel development strategies and the evolution of leadership styles.

The study highlighted that in an environment where professional knowledge and skills are rapidly becoming obsolete, competencies such as digital literacy, critical thinking, adaptability and self-organisation are becoming as important as highly specialised knowledge. It requires managers to move from directive management to coaching leadership, where the main emphasis is on mentoring, supporting self-reflection and encouraging employees’ “learnability” – their ability to adapt quickly to new conditions and master new things. Changes in learning have directly affected team behaviour, promoting greater collaboration and knowledge sharing, internal processes and communication, which is becoming more open and transparent. The continuous development and recognition of new competencies significantly increase employee motivation and contribute to the formation of an organisational culture, where continuous learning is an integral part of professional life.

This paper proposed a number of strategic recommendations for the successful development and comprehensive implementation of lifelong learning at the national and corporate levels, as well as to overcome existing barriers such as the digital divide, lack of motivation and educational mismatch. The key tasks include developing a flexible educational infrastructure, including holistic ecosystems with access to modular programmes and micro-qualifications, which should adapt quickly to the labour market and individual requests, guaranteeing a wide choice of resources; recognising non-formal and informal learning, including assessing practical experience and developing mechanisms for validating this knowledge, which will increase motivation for self-education; increasing digital inclusion, which will ensure equal access to technologies and basic digital skills for everyone; using multi-level motivational mechanisms, linking learning with career growth, promotion and salary increase; introduction of digital certificates and tax benefits that will reduce the financial barrier; gamification and interactive formats that will make learning more interesting and effective. The proposed recommendations should be implemented comprehensively to create a favourable environment for the continuous development of human capital in the context of digital transformation. Further research can be aimed at developing specific methods for integrating AI tools and gamification to personalise lifelong learning in a corporate environment, taking into account the features of the

Ukrainian labour market and its adaptation to the requirements of the global digital economy.

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Лайфлонг-навчання в цифрову еру: як змінюється підхід до розвитку людського капіталу

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Анотація. В умовах цифрової трансформації і змін на ринку праці традиційні підходи до розвитку людського капіталу втрачають ефективність, натомість актуалізується безперервне оновлення знань і навичок як ключова умова конкурентоспроможності працівників і організацій. Мета дослідження – виявити тенденції у зміні освітніх парадигм, проаналізувати вплив цифрових технологій на формування вимог до компетенцій працівників, а також дослідити найкращі практики впровадження лайфлонг-навчання на індивідуальному, організаційному та державному рівнях. Для досягнення мети застосований комплексний міждисциплінарний підхід, що поєднує теоретичні засади лайфлонг-навчання, теорії людського капіталу і психології навчання з емпіричними методами, зокрема контент-аналізом, порівняльним і системним аналізом освітніх стратегій і політик. Результати дослідження показали значний вплив цифрової трансформації на вимоги до компетенцій працівників. Установлено, що наразі значення мають не лише традиційні професійні знання працівника, а й цифрова грамотність, метакомпетенції і здатність до постійного навчання. У дослідженні також виявлені значні зміни в освітніх парадигмах, з переходом від традиційних форм навчання до гнучких моделей, орієнтованих на індивідуалізацію і використання цифрових технологій. Онлайн-курси, корпоративне навчання, мікрокваліфікації стають важливими компонентами освітніх екосистем. На основі контент-аналізу встановлено, що наразі організації відіграють активну роль у розвитку людського капіталу через інвестування в навчання і перекваліфікацію своїх працівників. Порівняльний аналіз досвіду впровадження систем лайфлонг-навчання у різних країнах виявив ряд проблем, включаючи цифровий розрив, недостатню мотивацію до навчання, невідповідність освітніх програм потребам ринку праці. На підставі проведеної роботи запропоновані рекомендації для подальшого впровадження лайфлонг-навчання з метою забезпечення розвитку людського капіталу. Практична цінність дослідження полягає у формуванні теоретичної бази для вдосконалення освітніх програм, корпоративного навчання та державної політики, спрямованої на підтримку лайфлонг-навчання в умовах цифрової економіки

Ключові слова: цифрова трансформація; компетенції; метакомпетенції; цифрова грамотність; онлайн-навчання