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THE INFLUENCE OF DIGITALIZATION AND ARTIFICIAL INTELLIGENCE ON HUMAN RESOURCES TRAINING

Abstract: *We analysed and systematised the influence of digital and intellectual technologies on the quality of human resources training in various sectors. Among the leading countries in the sphere of digitalization and artificial intelligence (AI), not all governments actively participate in improving the digital readiness of personnel and their advanced training connected with new requirements to specialities. Certain countries (the USA, Israel, and the Netherlands) demonstrate high indicators of labour resources' adaptation to challenges that emerge due to the emergence of new digital technologies (including AI). The experience of these countries shows higher sustainability of their economies and social sector against crisis phenomena compared to countries that have not yet adopted cardinal changes – at the state level – in the sphere of personnel management in the conditions of digitalization. Among all considered countries, the highest efficiency in raising the quality of human resources training in the conditions of digitalization and AI is demonstrated by the Netherlands, which, based on the focus on cooperation with business and the scientific & technological sector, implements the main measures of collaboration.*

The goal of this paper was to establish the features of the influence of digitalization and AI on human resources training. The methods we used for this include comparative analysis, subject analysis, and the rankings method.

The scientific novelty of this paper is due to the establishment of the models of human resources training, which are used in the considered countries in the conditions of the impact of digitalization and AI.

Keywords: *Digitalization, AI, Human resources training, Quality, Digital/Technological skills, World Digital Competitiveness, Skills, Qualification*

1. Introduction

Transformations of the forms of information exchange, management, and communication, which took place over the last ten years, introduced changes in all spheres of socio-

economic development of countries. Improvement of digital infrastructure, especially in the level of coverage and quality of the Internet, and adaptation of digital electronics to new technologies (including AI means) allows implementing certain managerial decisions in a new

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quality. This also concerns the quality of human resources training, which is ensured by special organisations and at the level of companies that are interested in the improvement of personnel's mastering new knowledge and skills. Measures on an increase in the quality of human resources training are used mainly by large companies which have subsidiaries in other countries. International integration of productions involves also the integration of the quality of products and services, which can be achieved due to an increase in the level of training of labour resources. If the company's main office is located in one country, and production, services centres, and subsidiaries are located in other countries, there's a need to find the most optimal managerial solution for human resources training without relocation of tutors. Digitalization and AI, which became widespread in the 2020s, turned out to be the most optimal foundation for the creation of systems of human resources training without the focus on borders, language differences, etc. Their effective use in this direction is possible if territories from which interaction in the sphere of human resources training is conducted have a high-quality of digital infrastructure, and labour resources possess basic digital knowledge.

A high concentration of transnational corporations, which function primarily in the high-tech sphere, allows countries that accept them to ensure the growth of GDP and raise the quality of human capital. Accordingly, countries must strive towards an attractive digital environment to attract innovative technological companies, which can create a synergetic effect from activities on their territories.

It is also important to create a favourable climate for labour resources in the sphere of production and the scientific & technical and technological spheres, as well as ensure conditions for the attraction of talents that can raise the effectiveness of national and international companies. Accordingly, there is a need for a constant increase in the

quality of education and conditions for life activities for young specialists. The provision of basic digital knowledge of labour resources (including job seekers) is necessary for the demand for personnel with companies.

2. Methodological basis of the research

The methodological basis of this research envisages the focus on the network approach, which is connected with the establishment of network participants (parties interested in an increase in the quality of digital training of labour resources); determination of their influence on the level of human resources training given new requirements of the digital economy and trends of AI; identification of network components that are responsible for the improvement of digital skills and knowledge of personnel; determination of activities of network components in this process; identification of the most efficient participants in the context of network interaction in the considered countries.

The research materials include statistical and analytical data and theoretical & empirical works.

Klinker and Weel (2024) analysed an increase in the level of employment and dynamics of wages in the Netherlands under the influence of socio-economic policy and the growth of skills and knowledge of labour resources that were received due to a new strategy of digitalization implemented in 2022. The scholars demonstrated that this growth was caused by the government's participation in the reduction of socio-economic inequality, which could appear due to the impact of the COVID-19 pandemic and more favourable conditions for the improvement of skills and knowledge of personnel. Due to digitalization, labour resources received access to information about the possibilities to improve the execution of their professional duties with

the application of digital technologies and innovative equipment.

The study by van Kersbergen and Vis (2022) is devoted to the analysis of the policy of Denmark and the Netherlands aimed at the management of the process of global social acceleration in countries which is connected with the emergence of new technologies in all sectors and spheres. The authors demonstrated the high adaptability of the two countries in the context of the resolution of acute social problems caused by digitalization. Among the key aspects of regulating social acceleration, Denmark and the Netherlands selected timely reactions to new trends in the economy and technologies, precise assessment of requirements to personnel, development of the optimal motivational system for all interested parties in the sphere of formation of digital technologies, and change in strategies given new challenges.

Fenwick et al. (2024) dwelt on the problem of the creation of workplaces that are integrated into the AI environment and, at the same time, oriented towards the socio-psychological features of humans. Bujold et al. (2023) analysed theoretical & empirical studies on the issues of such risk in the application of AI in labour resources management as a responsibility. The problem of responsibility concerns the creation of programmes for an increase in the quality of digital skills and knowledge of employees; and monitoring of personnel's activities with the use of computer vision, which would take into account ethical norms.

Semenova et al. (2024) demonstrated problems and barriers faced by companies that desire to conduct an audit of the quality of products and processes with the use of AI technologies. The authors state that despite the speed, low cost, and precision of such audits, there is a problem with the human factor. According to them, there is a necessity for adjustment of the parameters of audit, which are the basis for machine

learning. Company specialists, who must undertake this procedure, very often do not have the required competencies, which is an obstacle to the companies's focus on the use of AI technologies.

Kozhakhmetova et al. (2019) assessed factors that ensure the efficiency of the implementation of projects in the sphere of IT in companies from Japan, Israel, and Kazakhstan.

Irmatova and Akbarova (2023) studied women's employment in the context of digital technologies development and proposed recommendations for women and organizations to expand their usage of technological capabilities.

Nawaz et al. (2024) identified the connection at the level of advantages of AI technologies and assessed their influence on the quality of HR management. The main advantages of AI, according to the authors, include the effect of cost savings, time-saving for processes, personalised human resources training within their knowledge; the precision of procedures; the possibility of automatized management; large computational capacities of big data analysis and forecasting; the possibility of personnel's acquiring digital experience in real-time. We think that the relevance of the presented materials consists in substantiation of the direction connection between the power of software, in which AI is used, and precision, time-saving, and cost savings for processes. An important contribution of the authors is the formulation of the list of AI technologies that are most optimal in the growth of the quality of labour resources training.

Further on in this paper, we systemically determine the features of the positive influence of the described phenomena on the quality of labour resources training.

3. Experimental setting and methods

To achieve the goals of this research, we selected a range of methods which allow

establishing the features of the influence of intellectualisation and digitalization on the quality of human resources training.

The method of comparative analysis enabled us to evaluate the impact of digitalization and AI technologies on the quality of labour resources training in companies of the selected countries.

Subject analysis allows us to determine the level of participation of the interested parties in the realisation of programmes for the improvement of the quality of human resources training in various companies.

The ranking method allowed us to determine the positions of countries by the considered indicators (digitalization, implementation of AI technologies, and quality of human resources training).

The goal of this research was to establish the features of the influence of digitalization and artificial intelligence on human resources training. To achieve this goal, we identified countries with a high level of quality of human resources training and determined the

features of the influence of digital technologies and AI technologies on the quality of human resources training.

4. Results

Analysis of the influence of digitalization and AI on labour resources training was performed by the example of companies from countries with high achievements in the sphere of human capital quality. To reveal this influence and establish practices in this sphere, we determined a list of countries that demonstrate a high level of human resources training. The quality of human resources training was assessed based on the indicator of Digital / Technological skills, according to IMD (2024) (Table 1). Analysing the state of this indicator, we also analysed the level of digitalization and integration of AI. Digitalization of the countries was determined with the help of the indicator of World Digital Competitiveness.

Table 1. Quality of human resources training in the selected countries

	Country	Digital / Technological skills, Rank	World Digital Competitiveness, Rank	The Global AI Index, Rank	Mutual influence of the indicators
1	Finland	2023 – 2, 2022 - 3	2023 – 8, 2022 - 7	15	Growth of the quality of training with a high level of digitalization and level of the use of AI
2	Saudi Arabia	2023 – 6, 2022 - 7	2023 – 30, 2022 - 35	14	A direct positive connection between the improvement of variables of AI and digitalization and the quality of labour resources training
3	Netherlands	2023 – 5, 2022 - 6	2023 – 2, 2022 - 6	13	The positive direct influence of the indicators on the quality of human resources training
4	Switzerland	2023 – 16, 2022 - 18	2023 – 5, 2022 - 5	12	The direct influence of the high level of digitalization and expansion of the spheres of application of AI on the improvement of the quality of human resources training
5	Japan	2023 – 63, 2022 - 62	2023 – 32, 2022 - 29	11	Direct influence on the decrease in the indicator of human resources training due to the reduction of digitalization ranking
6	India	2023 – 21, 2022 - 17	2023 – 49, 2022 - 44	10	Director negative connection between the reduction of the quality of digital infrastructure and the quality of human resources training

7	Israel	2023 – 14, 2022 - 19	2023 – 13, 2022 - 15	9	Positive effects from the improvement of the development of AI and digitalization
8	Canada	2023 – 18, 2022 - 14	2023 – 11, 2022 - 10	8	Direct influence on the reduction of the quality of human resources training due to a decrease in the level of digitalization
9	Germany	2023 – 58, 2022 - 52	2023 – 23, 2022 - 19	7	Decrease in the quality of Digital / Technological skills over 2022-2023. No effectiveness of the influence of AI and digitalization due to the complex system of financing of human resources training of companies in various sectors.
10	South Korea	2023 – 48, 2022 - 46	2023 – 6, 2022 - 8	6	No influence of digitalization and AI on the quality of human resources training. The country has a low level of financing for quality training and retraining of personnel due to trends of change in technologies. High investments from certain large transnational corporations.
11	France	2023 – 31, 2022 - 28	2023 – 27, 2022 - 22	5	Reduction of indicators, connected with a decrease in investments in the digital infrastructure and AI. Each citizen can receive government financing for the improvement of knowledge and skills during the labour life (EUR 500-800 per year) (since 01.01.2015, there is a possibility to open a personal training account on the specialised government website). Despite the government's support, the indicator of training was reduced because of insufficient information support of necessary courses and workshops.
12	United Kingdom	2023 – 26, 2022 - 24	2023 – 20, 2022 - 16	4	The value that is above average with simultaneous deterioration of indicators, the direct influence of reduction of digital infrastructure
13	Singapore	2023 – 12, 2022 - 9	2023 – 3, 2022 - 4	3	Worsening the quality of human resources training despite the improvement of digitalization and the high level of the use of AI. High level of government's support of the system of financing of advanced training of people above 30 who work in companies. The level of reimbursements for companies for financing training courses and programmes is from 50 % to 95 %. Deterioration of the quality of training is connected with a decrease in the offer of courses within special technical specialities.
14	China	2023 – 13, 2022 - 12	2023 – 19, 2022 - 27	2	Effective impact with the growth of all indicators
15	United States	2023 – 9, 2022 - 10	2023 – 1, 2022 - 2	1	Positive connection against the background of improvement of indicators

Source: Compiled by the authors based on materials by IMD (2024), Tortoisemedia (2024), Bibb.de (2024), OECD (2021), Ipag.edu (2023), and Skillsfuture.gov.sg (2024)

Based on data from Table 1, it is possible to state that the most positive and leading results are demonstrated by the Netherlands, Israel, and the USA.

According to materials by Digital-skills-jobs.europa.eu (2024) and Nederlanddigitaal.nl (2024), a national strategy of digitalization aimed at the sustainable development of the economy and

social sphere were started in the Netherlands in 2022. We revealed a range of milestones of strategic development of digitalization in the country, which include the following:

- Increase in digital sustainability (quality and coverage of the Internet);
- Improvement of the quality of digital communications;

- Development of e-government. Improvement of this sphere allows ensuring remote interaction of business subjects and the government at different levels in the context of solving the issues of human resources training (retraining and improvement of knowledge and skills);

- Improvement of digital inclusivity to ensure the growth of knowledge and skills of people with special needs and improvement of the quality of digital knowledge and skills for labour resources;

- Improvement of data science and application of its achievements to reach economic and social tasks. Large attention is paid to the development of new scientific and technological solutions in the sphere of the collection of data on changes and forecasting of the economy and social sphere in the changing conditions of global digitalization. This direction allows ensuring constant flows of large databases and their quick systematisation and analysis, with forecasting of options of changes and preventive measures;

- Growth of the use of AI in the economic, infrastructural, and social spheres. In the context of improvement of knowledge and skills, this measure involves the focus on the wider implementation of chatbots that work with machine learning, analysis of big databases; robotization (robotized software for training and demonstration of the order and rules of solving certain tasks within various professional competencies); computer vision which can perform monitoring of execution of certain professional tasks for the following corrections from the operator.

Support of digital skills and knowledge for labour resources, population, and citizens

with special needs is the key focus of the considered strategy of digitalization in the Netherlands. The strategy indicates that measures in this sphere are aimed at training labour resources for constantly changing labour conditions and ensuring their socio-economic and technological protection (continuous training, sustainable employment, and constant improvement of professional knowledge in the conditions of digitalization). Measures ensured due to the implementation of the new strategy of digitalization of the Netherlands in the improvement of digital skills and knowledge, which are achieved due to the integration of AI technologies, including the following:

- Optimisation of the flexibility of the creation of training programmes and their budgets given the demands of labour resources;

- Improvement of electronic state management of the processes of training, advanced training, and retraining of labour resources of the country (enhancement of the quality of the digital platform on which citizens, who participate in constant professional growth during their entire lives, register);

- Government's support in the creation of pilot projects on training the personnel of small and medium companies in various sectors of the economy;

- Attraction of experts, specialists, and scholars for the creation of new digital knowledge and skills under the influence of transformations of technologies and processes that take place in the modern digital economy based on AI technologies. New digital skills and knowledge become formalised due to the government's participation in financing the corresponding programmes.

The presented programme of digitalization in the Netherlands was started in 2022. As a result of its realisation, the following could be noted:

- Growth of wages and level of employment of labour resources. Over 2020-2-2023, there

was observed the growth of the population's employment by 2.3 % (Klinker and Weel, 2024);

- Stable level of unemployment compared to its growth in certain EU countries. This was achieved due to the creation of favourable conditions for the improvement of professional skills and knowledge, including a focus on digital technologies. In 2023, compared to 2022, this indicator in the Netherlands remained at the level of 3.5 % (Statista, 2023), while in the EU it equalled 5.9 % (Eurostat, 2024);

- Improvement of social standards (growth of wages for employees with minimum qualifications or without any), which led to the growth of wages in 2023 compared to 2022 by 7.1 %. This growth continued in 2024: over January-July 2024, this indicator grew by 5.2 % compared to the similar period of 2023 (Jacobs, 2024). This was due to the support of the well-being of labour resources due to inflation, which began growing in the EU in 2022; teaching employees certain digital skills that facilitate the expansion of their competencies;

- Coverage of the country's population with basic digital skills. By the end of 2023, this indicator equalled 82.7 % in the Netherlands, while in the EU it was 55.6. The goal is 80 % by 2030. This fact demonstrates that companies of various sectors are in more attractive conditions regarding the quality of digital readiness of personnel compared to the similar indicator in countries of the EU where the level of mastering of digital skills is at a comparatively low level. This result was achieved in 2022-2023 due to the above strategy of digitalization and improvement of digital skills and knowledge of labour resources;

- The share of ICT specialists in the total number of employed population was 6.9 % as of year-end 2023, while in the EU this indicator equals 4.8 %. This shows that due to attractive conditions of work and life, the government stimulates keeping talents in the sphere of ICT, ensuring an increase in the digital competitiveness of the economy. In

this case, the benchmark for a high concentration of ICT specialists in the Netherlands is the quality of digital infrastructure in various regions of the country, which provides the possibility for remote work; opportunities for office rent for companies that work in the sphere of creation and maintenance of software; access to loans, etc.;

- Functioning of the public-private partnership NL AIC, which includes organisations and establishments of the scientific and educational sector, unions, and subjects of the business sector; it updates requirements to a wide range of professions given the integration of digital (including intellectual) technologies into certain processes at the level of various sectors of the economy; ensures formalisation of new requirements and determines new skills and knowledge; finances the transfer of new skills and knowledge to the personnel of companies of the private sector and organisations of the public and municipal spheres;

- Implementation of the Smart Industry programme, which was started in 2014. This programme is focused on the digitalization of processes and the constant improvement of the quality of digital skills and knowledge of the personnel of companies in the processing industry. Due to this programme, the personnel of the companies of the processing industry in the Netherlands demonstrate a high level of digital skills and knowledge and use them to adapt their professional knowledge.

According to Curry (2024), an increase in the quality of human resources training in the sphere of mastering new technologies (including AI technologies) in the USA is ensured mainly due to the initiatives of employers. Among AI technologies that contribute to the improvement of professional skills and knowledge at the corporate level in the USA are the following:

- Generative AI, which is based on the use of big databases, machine learning, and neural networks. Here chatbots for teaching certain

processes and schemes are used. These chatbots work primarily through the system of key tips, performed by authorised employees, in the form of visual or audio instructions for the execution of a professional task. More than 70 % of the top managers of large US companies state that their personnel have full access to digital knowledge about their professional tasks and functions. However, this is confirmed by 37 % of employees and 53 % of middle managers. A large share of employees cannot receive the necessary professional support from corporate chatbots, because the machine learning of many of them is conducted based on databases created at the sectorial level without attention to the technological features of the company;

- Robotization of production, which involves knowledge and skills of personnel in the sphere of the management of technology and information systems.

Despite the existing problems in mastering digital technologies (including AI technologies), American corporations achieved significant success in this sphere. This is due to the improvement of technologies (adaptation of chatbots to the conditions of companies' functioning).

Initiatives of the companies of various sectors of the USA demonstrated stable growth in the level of employment since 2013, including under the influence of the growth of the level of digital skills and knowledge of personnel. While in 2013 this indicator equalled 58.6 %, in 2015 – 59.3 %, in 2017 – 60.1 %, in 2019 – 60.8 %, in 2020 it dropped down to 56.8 % (due to the influence of the COVID-19 pandemic, in 2022 – 60 %, and in 2023 – 60.3 % (Statista, 2024). Recovery of the economy and employment after COVID-19 was ensured including by the efforts of corporations that conducted digital transition in the sphere of human resources training.

The business environment of Israel demonstrates a high positive dependence on the use of digitalization and technologies of AI and the quality of human resources training. An increase in the quality of human resources training in the context of the focus on digital (including intellectual) technologies is due to government, international, and corporate initiatives.

The government's participation includes support for large companies (including transnational corporations) with productions in Israel, to attract skilled specialists and train local personnel in the sphere of digitalization, mastering of AI, and development and production of high-tech products. The programme Call For Proposals (CFP) envisages international support at the level of 50-70 %, with the remaining financing from the government. In 2024, there was held a tender for 10 million shekel for attraction of skilled foreign specialists in the sphere of IT in large companies (Innovationisrael, 2024). The focus on large IT companies is due to them being leaders in the innovative technological development of the country. The work of these specialists allows raising the level of knowledge and skills of companies' personnel due to the constant exchange of experience and frequent workshops.

At present, Israel implements a national programme in the sphere of AI. Its financing equalled USD 250 million in 2024. This initiative includes the creation of a supercomputer and generative AI technologies (Scheer, 2024). The key foal of the programme is the world leadership in AI. Since the programme involves academic and production circles, the personnel of participating companies can raise their level of skills and knowledge. The transfer of experience and knowledge in Israel is oriented towards applied tasks, the execution of which is laid onto the personnel of large companies in cooperation with skilled specialists who are also tutors.

5. Discussion

Analysis of the features of the influence of digitalization and AI on the quality of human resources training allowed formulating national models of ensuring digital skills and knowledge in the studied countries.

As for the Netherlands, we may note the proactive government policy in bringing the level of knowledge and skills of citizens (including the employed population to the requirements of the profession, which emerges in the conditions of the quick growth of new digital intellectual technologies. This policy ensures a vertical model of regulation of digitalization of the economy and social sector, managed by the government. Management in this case is connected with the support of companies and economic sectors in the improvement of the digital readiness of personnel. The government policy of the Netherlands is oriented towards a quick and effective reaction to the transformations of technologies and the necessity of supporting the quality of national human resources as a long-term basis of sustainable development in the conditions of constant economic challenges.

The USA uses a model of corporate social responsibility in the context of implementing new technologies (including AI) to raise the quality of human resources training in the conditions of optimisation of their digital readiness to the constant changing technological support of processes. Over the entire period of digitalization and the use of AI, the business environment remains the key source of digital increase in the quality of labour resources in the USA. This model of improvement of the level of human resources training is possible in the conditions of market regulation – in the environment where large transnational companies function.

Israel implements a vertically oriented model of improvement of the quality of human resources training, initiated by the government that seeks to raise the digital and

intellectual competitiveness of personnel. Investments from international funds and the government are the basis of the national course aimed at world leadership in the sphere of IT. Large companies are active participants in such innovative programmes, but their financial participation is more limited. The country's approach to improving the quality of human resources training in the long term will be transformed due to the necessity of supporting small and medium companies in the IT sphere and other innovative spheres.

6. Conclusions

In the course of this research, we received proof of the direct influence of digitalization and AI technologies on the quality of human resources training in companies by the example of selected countries. Countries with a high level of digitalization and use of AI but insufficient quality of digital skills and knowledge did not implement measures in the spheres of training and improvement of qualification given new trends and processes of production management. These countries include Japan, Germany, and other countries, which plan on realising the measures of creating a favourable environment to acquire new knowledge, which would allow the personnel to be ready for constant challenges in the context of technologies and the need for mastering new specialities.

Responsibility for socioeconomic challenges, which are connected with digitalization and AI, is set onto governments and companies in the sphere of IT and companies that integrate new technologies. Accordingly, each country, at the level of interested parties, must determine a range of obligations in retraining and advanced training of personnel and improvement of the quality of knowledge and skills of employees in all sectors. This will reduce the socioeconomic gap that may emerge in the course of further dissemination of digitalization and AI.

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