Factor of Digital Culture in the Application of Artificial Intelligence in Economics and Education

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***Abstract*—The purpose of the article is to attract the attention of young researchers of research on the problems of digital culture as one of the most important factors in the successful development and implementation of artificial intelligence technologies. It is shown that the relevance of the development and application of AI technologies is due to the growing complexity of the objectively necessary tasks of economic management and the ever-increasing pace and scale of digitalization. The importance of the digital culture factor in the formation of a digital environment comfortable for life and interaction is noted, which determines the effectiveness of synergistic processes of self-assembly and self-organization of complex dynamic systems, which are modern society and economy in the context of global digitalization. The role of digital culture is analyzed as a science about the relationship of people to each other in the digital environment and the environment itself with the outside world and as an institution for achieving excellence in the creation and application of digital technologies and artificial intelligence technologies.**

***Keywords*—artificial intelligence, digital culture, synergistic effects in the economy and society, digital culture in the economy and education, digital culture of the enterprise.**

I. Introduction

Currently, artificial intelligence (AI) is entering a new phase of development and is increasingly becoming one of the main catalysts for change in the economy and education.

At the same time, decisions on how to use this technology, to balance risks and opportunities, are made primarily by large corporations, relegating to the background research on assessing the risks of developing and implementing applications with AI technologies. As a result, the development of AI is very contradictory and zigzag.

If in 2022 32 significant industrial machine learning models were created, then only 3 by scientific centers. There is a tendency to reduce the departments dealing with ethics and security issues in corporations like Microsoft or Google. This is mainly due to the fact that AI technology has begun to require more and more resources: personnel, information (databases) and computing power necessary to create such applications. At the same time, there is a growing interest in the regulation of AI from the public administration: an analysis of the situation in 127 countries showed that the number of laws adopted in different countries containing the phrase "artificial intelligence" has grown from 2nd in 2016 to 37th in 2022 [1].

It is obvious that with the growing concerns about the impact of AI on the labor market, the regulation of the use of AI will be improved in various directions, which requires the development of an appropriate methodological framework for assessing the risks of AI and choosing directions for the development and application of applications with AI technologies. In terms of areas, in our opinion, these are economics and education. In terms of methodology, this is the application of the principles of synergetics to the construction of qualitative models (phase portraits) of economic development under the influence of the growth in the use of AI in various fields of activity with an assessment of the impact of the level of human development on the consistency and success of society development.

II. The objective necessity of AI

According to the conclusions made by academician V.M. Glushkov [2] in the early 70s of the last century, the complexity of objectively necessary management tasks is growing faster than the square of the number of people employed in the economy of people. Since, as a result of the constant development of technologies and organizations, the complication and deepening of specialization and cooperation between economic entities, new connections arise, and hence new management tasks. At the same time, the number and complexity of emerging tasks and the number of people employed in the economy have a non-linear relationship, which makes it difficult to build integrated planning and economic management systems in the context of digitalization: building a digital state plan and a digital strategic management system.

Appropriate training and retraining of personnel is of key importance. If in recent centuries mental abilities were more important than emotional skills and the ability to work with hands, then now, there is a reversal of the trend — emotional (social) skills, such as empathy, the ability to build relationships and persuade, come to the fore. At the same time, the balance between cognitive and social skills will change significantly even in traditionally intellectual professions, which necessitates appropriate changes in the education system related to the development of emotional intelligence among schoolchildren and students and its adaptation to activities in the digital environment. Emotional intelligence is considered as important as mental ability (IQ) because it helps to establish teamwork and achieve synergies in production and management while reducing the number of employees. With regard to AI, it is assumed that intelligent digital technologies will replace people in routine tasks, and people will be successful in activities that require good social skills (soft skills) and interdisciplinary experience.

III. Synergetics is a "gathering point" of opinions on the directions of digitalization and the application of artificial intelligence technologies

The main goal of numerous theories of digital transformation and AI is an attempt to build certain models to predict the development directions of this process in order to increase the efficiency of the economy and the sustainable development of society [3].

In the last two decades, in the analysis of various problems, the principles of synergetics are increasingly used — the science of the processes of development and self-organization of complex systems, which, undoubtedly, is any modern enterprise. The main thing in synergetics is the self-organization of the components of complex systems when a certain variety of elements and relationships between them are reached, and the presence of a certain degree of culture of production participants.

Self-assembly refers to the process of combining system components into horizontal structures. And self-organization is the emergence of qualitatively new structures (bifurcation) as a result of multiple interactions of components of lower hierarchical levels in order to form a production environment that is comfortable for interaction — convenient, fast, with minimal barriers.

In practice, various irrational phenomena in the course of digital transformation are encouraged to turn to synergetics, which are not always amenable to clear definitions and explanations, but are definitely determined by the level of organizational and digital culture of the employees of the enterprise.

In a more simplified cybernetic representation, an enterprise is a program that ideally works according to self-assembly and self-organization algorithms through the dynamic formation of a cultural environment and cultural code (skills, abilities, traditions, values, ethics, aesthetics). This program "works" in the direction of ever faster, more diverse and simplified interaction of the elements of the enterprise to create higher forms of organization in accordance with the laws of natural harmony.

With this approach to considering the digital transformation of an enterprise, it becomes possible to analyze production and get an explanation of the reasons and forecasts for the development of modern digitized enterprises.

It is important to note the interdisciplinary nature of the synergetic method, which requires the joint efforts of scientists and specialists from various fields — from philosophers, artists, mathematicians, engineers to managers and system analysts.

It can be assumed that both the industrial revolution in the past and the modern information and digital revolution are the result of the adaptation of people and industries to new technologies. In turn, the problem of creating an information and digital culture is to form the environment and people's skills (digital competencies) as a condition for self-assembly and self-organization. The understanding of technologies should turn into a desire to use them effectively.

At the same time, as practice shows, the main engine of self-assembly and self-organization is artificial intelligence (AI), on the level of development and application of which economic growth and quality of life depend.

IV. Principles of synergetics in the development of the economy

The structure of the economic system and society as a whole is determined by the nature of the interaction between its elements. From the point of view of synergetics, the goal of the economy as a subsystem of society is the self-organization of producers and consumers of goods and services, which works according to the pricing model "goods — money — goods". The current market economy is focused on the concentration of ownership, which leads to the division of players into active and passive ones. In the time of Adam Smith, the economy was a market economy as long as producers and consumers strictly followed the postulates of the Protestant ethic [4]. Over time, the ethical culture of self-organization of the economy under the influence of the imperative of profit was increasingly eroded, leading to an increase in inequality in society, which was offset by an increase in consumption and a decrease in the birth rate in the most civilized countries.

In a planned economy, self-organization was hampered by excessive administrative regulation of the forms of interaction between economic agents and prices for products and services. Therefore, it is necessary to move to

a new paradigm — a digital sharing economy, which will give a new impetus to self-organization due to the greater information content of consumers and producers and the growth of opportunities for their cooperation in the production of goods and services. That is, cultural self-organization is required first, and then economic self-organization takes place.

The digital economy of the future is an inclusive, solidarity and sharing economy, which means the maximum involvement of the population in production, the distribution of income in accordance with collective interests, the maximum efficiency in the use of the country's resources through cooperation between enterprises and individuals based on trust and transferring responsibility for work to lower levels of decision making. As a result, there is more space for the emergence and development of new ways of entrepreneurship and cooperation between producers of goods and services and taking advantage of the digital environment.

V. Features of the digital environment

The digital environment is an integral part of the natural and virtual worlds surrounding a person and becomes as significant as the natural world. The speed and extent of change is critical. The forecast of unregulated development of the digital environment is not optimistic. It is not those who provide quality content that win, but those who quickly gain a critical mass of consumers. The intelligence level of data processing systems ("digital footprints") is growing, but trust in the system is decreasing. Deepfakes and chatbots increase the entropy of the environment, which goes into the turbulence stage. The environment is no longer conducive to the production and perception of new information, ceases to be useful for development and increases cognitive degradation. The pattern of thinking and the pattern of behavior are changing. New synergies are emerging, and the challenge is to predict bifurcation points and define digital development trajectories. The maximum effort is to determine what measures should be taken. To do this, it is necessary to define some research framework and methodology. For a qualitative assessment of development, synergetics is most applicable, among the priority measures is raising the level of digital culture [5].

The four new laws of robotics formulated in Frank Pasquale's book also confirm the growing importance of culture in the creation and application of AI systems [6]:

1) Robotic systems and AI should complement professionals, not replace them.
2) Robotic systems and AI should not pretend to be people.
3) Robotic systems and AI should not fuel a zero-sum arms race.
4) Robotic systems and AI must always contain an indication of the identity of its creator (or creators), operator (or operators) and owner (or owners).

VI. Digital culture

Digital culture is the science of the relationship of people to each other in the digital environment and the environment itself with the outside world. In the most general sense, digital culture can be viewed, on the one hand, as an institution for achieving excellence in the creation and application of digital technologies, on the other hand, as a set of practices for regulating the behavior of people and communities in the digital environment. The methodology for creating an environment with such characteristics is based on the synergistic principles of self-assembly and self-organization of complex dynamic systems, such as modern society and the economy in the context of global digitalization. Synergetics makes it possible to connect the humanities and natural sciences and gives an understanding that we live in a highly nonlinear world, that social systems are historical and depend on their "trajectory" in the past [7].

The phenomenon of digital culture, due to its complexity, should be considered at three levels: a person, an enterprise (community) and society as a whole:

1) With regard to an individual, the essence of culture is the development of imaginative thinking, which allows you to create an ethical coordinate system for life in a digital environment. Culture creates appreciation and self-esteem of the individual in digital interactions. Digital culture is the ability to understand the patterns of development of digital systems, which gives a person additional vitality to solve complex problems and determine their role in shaping the digital environment. It is conscious activity in the digital environment that gives rise to digital culture.
2) In relation to the enterprise, digital culture is what employees do, what they believe in and how they behave over time, that is, it is the attitudes, behaviors and habits associated with digital technologies that employees repeat over time.

For an enterprise, digital culture is to some extent a task, after completing which one can begin to solve the technical and organizational problems of introducing new technologies into production and management. That is, understanding that the digital environment predetermines both the appropriate organizational structure of the business and the behavior of the employee in terms of his competencies and values.

Cultural costs have a strong impact on the development of the traditional economy and have even greater consequences in the digital economy. The more complex the technology, the higher the requirements for qualification and quality of interactions. Studies show that over 30% of the obstacles to successful digital transformation of enterprises are due to the cultural and behavioral problems of employees and the unwillingness of managers to communicate effectively in the digital environment.

Therefore, the meaning of a developed digital culture for a modern enterprise is that everyone in the team listens to everyone and everyone, and everyone listens to everyone, which leads to the preparation of conditions for the development and implementation of AI technologies, as the most advanced digital technologies.

The effects that digitalization and the use of digital technologies give depend on thousands of small deeds of managers and personnel of enterprises that must be correctly and consistently performed, which requires appropriate information and cultural self-organization of enterprise personnel. This requires the integration of professional and cultural knowledge and skills, which requires the study and understanding of digital culture — a new direction in the theory and practice of digital transformation and the use of artificial intelligence systems.

For this reason, the global giants of the digital industry Google, Alibaba and others have long been using methods and algorithms to determine whether employees meet the specific requirements of the digital culture of modern "smart" companies (risk management, cooperation, the ability to act independently in flexible organizational structures based on horizontal connections and network coordination, decision-making based on intelligent data processing, personal participation in decision-making, etc.).

From the point of view of the development of society, digital culture can be considered as a humanitarian resource of digitalization, as an institution for achieving excellence in the creation and application of digital technologies in order to create a digital environment as comfortable as possible for interaction.

Digital culture is the understanding that digital transformation is primarily a social phenomenon that comes from new forms of communication and interaction between people through social networks, digital platforms and technologies. And, of course, for this, the digital environment must be "aesthetically charged", that is, it must be formed according to the laws of aesthetics and rationalization, minimizing the risks and threats of network communications. The main place of digital culture, as well as traditional culture, is the inner world of a person and the world of the community, for the maintenance of which constant self-improvement and the expenditure of human energy are needed, work on oneself and the formation of appropriate institutions to regulate behavior and interactions in the digital environment.

VII. Digital culture is the most important factor in the success of digital transformation

A 2016 McKinsey study showed that over 30% of the barriers to successful digital transformation are due to cultural and behavioral issues in enterprise employees. The digital economy is an ultra-low cost economy. But subject to the necessary level of digital culture. Manufacturing has one of the highest human error rates of any industry. At the same time, up to 70% of these errors are the result of imperfect organizational culture [8].

The specificity of digital culture is determined by the digital economy, which involves network coordination of the interaction of business processes and intelligent data processing, and therefore requires certain knowledge, skills and value orientations. First of all, the readiness to work in conditions of weakly hierarchical flexible systems of independent decision-making and understanding the increasing complexity of digital ecosystems as they function and develop.

From the point of view of systems theory, complex historically developing organic wholes (systems, which are modern large enterprises) must contain special information and organizational structures within themselves that ensure the management of the system and its self-regulation. These structures are represented by links and codes, in accordance with which the organization of the system as a whole is reproduced and the features of its main reactions to the external environment are recreated.

In biological organisms, this role is played by genetic codes (DNA, RNA). In society, as an integral social organism, culture acts as an analogue of genetic codes. In digitized enterprises, it is organizational and digital culture.

Therefore, the success of digital transformation is, to a greater extent, the result of a control action that comes "from within" the system (from the cultural predisposition to changes in employees, and not just from the outside), by creating conditions for maximizing the use of the skills and enthusiasm of the personnel of enterprises (the energy of human culture), which makes it possible to achieve synergistic effects from the interaction of employees (self-assembly and self-organization of individuals and communities) in the production of demanded goods and services.

For this reason, digital culture can be seen as an institution for achieving excellence in the creation and application of digital technologies in order to create a digital environment as comfortable as possible for interaction, self-assembly and self-organization of enterprises and individuals.

VIII. Digital culture and AI technologies in education

From the point of view of teaching, it is important, in our opinion, to note that digital culture is still science X, that is, not fully defined and with a pronounced interdisciplinary character. This is a kind of philosophy for the development of the digital world, and for various specializations, training in digital culture should be

carried out approximately sequentially, starting from the culture of dialogue and academic writing and ending with the cultural aspects of creating and applying artificial intelligence systems. At the same time, this approach makes it possible to combine the efforts of all faculties in research and the preparation of practical methods for digital culture. And it will enrich students with an understanding of the complexity, diversity and inconsistency of the development of the digital world. There is a place for everyone, both physicists and lyricists.

The theoretical model of culture is a kind of coordinate system, a system of key concepts that reveal the essence of culture. For the theory of digital culture, it is important to understand the differences between material culture and digital culture. Digital culture is formed through terms, operations, standards.

Education is a system of production of human capital, which is one of the most complex subsystems of society. Various studies show that humans can learn new things from AI systems and communicate them to other humans in a way that could potentially impact broader human culture. Algorithms using AI technologies are having an increasing impact on human culture, which requires understanding how they interact with us or with each other. Since, algorithms and AI are not simple means of cultural transmission (such as books or the Internet) and can also play an active role in shaping the processes of cultural evolution on the Internet, where people and algorithms regularly interact.

The highest priority is to improve the quality of content, the culture of dialogue and academic writing. This is a fundamental problem, literally and figuratively. Everything else depends on the quality of the primary data. This is the raw material for neural networks and decision-making systems (what we "feed" the neural networks will be the output). What is needed: an ordered object world and an ethically charged digital environment and a definition of who and how the value base will be created.

The problem with the spread of AI on a broader basis is trust - trust in the data that enters the systems and the decisions made by those systems. In modern societies, the most important condition for the development of artificial intelligence technologies is digital culture. A significant and growing proportion of AI algorithms operate online, both as bots that interact with the user and as sorting and guiding algorithms that mediate network interactions.

According to research, in 2020, up to 20% of companies' profits were generated thanks to artificial intelligence. At the same time, there were a number of obstacles to the successful use of AI, due to the influence of digital culture:

1) The quality of the preparation of primary data for systems for developing and making decisions, including with the use of AI technologies.
2) Insufficient consideration of the peculiarities of thinking and values of AI developers, which affects the ethical attitudes of artificial intelligence (understanding the humanitarian context of applications with AI).
3) The lack of a strategy in the organization of labor for the collection and filtering of primary data and their processing on various platforms.

The main reason for the new possibilities of artificial intelligence is the integration of its applications with modern digital technology, Internet technologies and big data.

The emergence of text generators based on AI technologies has opened a new era in global digitalization, creating both additional opportunities in data processing and analysis, and producing new risks and threats, primarily in the education system. The use of AI has led to the fact that human thinking has actually become combined: both the brain and the computer are involved in thinking, and it is required to optimize their interaction. The main risks are that there is a psychological danger of increasing dependence on a computer and a decrease in the level of mastery of knowledge due to a change in the technology of transferring knowledge: previously it was a teacher or an expert community who are in dialogue with the student. The use of AI reduces the learning format to a monologue.

It is important to note that learning is a process that results in the ability to recognize signs of new information according to a certain algorithm and then develop decision rules for developing managerial decisions and actions. Thinking models have a different format and require a different level of attention (the ability to identify signs of new information and give priority to one or another sign [9].

The inevitable emergence of ChatGPT is an objectively necessary response to the critically increased volumes and dynamics of data updates in the digital environment. At the same time, this is the next stage in the development of systems for systematizing and concentrating data on the way of their transformation into information and knowledge (books, libraries, catalogs, websites, search engines, etc.), that is, the formalization of knowledge to turn it into a resource for analysis and management decisions. . As one of the first Soviet cybernetics N. G. Zaitsev — data is not yet a resource, but a sign of a resource, and in order to turn data into a resource, an appropriate level of researcher training is required to recognize in these data what is necessary for development and interaction.

It can be assumed that the subsequent development of intelligent systems such as GPT will be carried out in the direction of greater specialization of content generators (texts, images, sounds) in areas of knowledge and an

increase in the level of their functionality in relation to specific types of activities. That is, it will be a process similar to the cataloging of various sources in specific thematic areas. This is an objective process, since information is a quantitative measure of order in a certain system. If there is no order, then entropy increases, which leads to degradation (aging) of the system.

At the same time, with the growing use of GPT-type generators for preparing information blocks, the problem of trust in information generated by AI arises. Especially in those cases when the content and configuration of the information block corresponds to traditional ideas and therefore is not subject to subsequent verification. As a result, the level of trust in information products obtained with the help of AI technologies is reduced. Moreover, the growth in the volume of products generated by chatbots will lead, in the shortest possible time, to the formation of a second-hand data layer in the global network, that is, containing only the data on which the chatbot was trained.

With regard to the economy and education, a decrease in the credibility of data from the Internet leads to the degradation of information and digital systems. Efforts to form a digital culture of users are aimed at preventing the negative trend of reducing trust in data on the network. At the same time, it is not, first of all, about changing the way people think, but starting with changing the way people behave and what they do.

The scope and integration of digital systems into the economy and society as a whole is so large-scale that it requires special attention and an integrated approach to raising the level of digital culture at all levels [10].

Digital culture can be viewed as an institution for achieving excellence in the creation and application of digital technologies in order to create a digital environment as comfortable as possible for interaction, self-assembly and self-organization of enterprises and individuals within a holistic digital ecosystem [11].

IX. Conclusions

Shaping a digital culture in the economy and society is a full-time job. Culture is a resource that cannot be acquired for any amount of money. Culture can only be developed through interaction. This is a blessing transmitted in the form of knowledge, traditions, norms, customs, rules. The sensitivity of employees of enterprises and the population to digital culture should be developed. The challenge of spreading AI on a broader basis is trust in the data that enters the systems and the decisions made by those systems. In modern societies, the most important condition for the development of artificial intelligence technologies is digital culture.

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Фактор цифровой культуры в применении искусственного интеллекта в экономике и образовании

Паньшин Б. Н.

Цель статьи состоит в привлечении внимания молодых исследователей исследований по проблемам цифровой культуры как одного из наиболее важных факторов успешного освоения и внедрения технологий искусственного интеллекта в интегрированных цифровых экосистемах. Показано, что вследствие самонастройки интеллектуальных систем происходит замещение механизмов экономического и административного принуждения механизмами самоконтроля и саморегуляции персонала и всей производственной системы, что обуславливает актуальность разработки приложений с применением ИИ как составной части единой цифровой экосистемы и предъявляет новые требования к системе образования.

Отмечена значимость фактора цифровой культуры в формирования цифровой среды комфортной для жизнедеятельности и взаимодействия, что обусловливает эффективность синергетических процессов самосборки и самоорганизации сложных динамических систем, каковыми являются современное общество и экономика в условиях глобальной цифровизации. Анализируется роль цифровой культуры как науки об отношении людей между собой в цифровой среде и самой среды с окружающим миром и как института для достижения совершенства в создании и применении цифровых технологий и технологий искусственного интеллекта.

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