

Formation and Development of Digital Society 5.0

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Abstract

The relevance of this research lies in the fact that in the context of the development of the Fourth Industrial Revolution, deep and systemic transformations are taking place, which act as the driving forces for changing paradigms (concepts, models, theories), which give rise to new megatrends of the digitized society, called digital. The fourth industrial revolution influenced the rapid development of the digital society, caused by deep transformation, fundamental technological changes and their social impact on culture, economy, politics, man, his consciousness and worldview. The formation and development of digital technologies, as a factor in the implementation of the Fourth Industrial Revolution, today include a set of

theoretical knowledge and practical skills of sustainable digital development, which requires the development of strategies and the selection of priorities that embrace large-scale digital technologies as the basis of a breakthrough in the technological industry. The object of research is the paradigm of digital society 5.0 as a complex social, cultural and economic phenomenon. The subject of research is the evolution of the digital paradigm of the economy, society and man in the direction of society 5.0

Keywords

digital paradigm, digital technologies, digital transformations, digital development, society 5.0

Introduction

The purpose of the article is the theoretical and practical aspects of the evolution of the digital paradigm of the economy, society and man from 4.0 to 5.0 Research objectives: (a) to investigate the conditions for the emergence of society 5.0; (b) provide a characteristic of society 5.0; (c) show the differences of society 5.0 from previous types of society; (d) find out the formation of the concept of Industry 5.0; and (e) justify the mechanism of introduction of the new model of society 5.0.

Analysis of Research and Publications

To analyze this problem, we use the works of K. Schwab (2017) "The Fourth Industrial Revolution," P. Mason (2015) "PostCapitalism: A Guide to Our Future," D. H. Meadows, J. Randers, D. L. Meadows (2004) "Limits to growth the 30-year update,;" T. O'Reilly (2017) "WTF?: What's the Future and Why It's Up to Us," M. Spence (2011) "The Next Convergence: The Future of Economic Growth in a Multispeed World," J. Studwell (2013) "How Asia Works: Success and Failure In the World's Most Dynamic Region," B. Christian & G. Tom (2016) "Algorithms to Live By: The Computer Science of Human Decisions," M. Goodman (2016) "Future Crimes: Everything Is Connected, Everyone Is Vulnerable and What We Can Do About It," S. Gupta (2018) "Driving Digital Strategy: A Guide to Reimagining Your Business," Kai-Fu Lee (2018) "AI Superpowers: China, Silicon Valley, and the New World Order". In these works, the authors implemented the conditions for the formation of a digital economy, society, and man thanks to advanced technologies, which require the formation of the concept of digital development of all fields of activity. Digital technologies form new trends and patterns of society, digital man, contribute to increasing productivity as a new deterministic force of long-term increase and improvement of living standards (Robertson & Lapiņa, 2023; see also Helbing et al., 2023). These technologies represent a catalyst for change. Industry 5.0 originates from the concept of "Industry 4.0", which was proposed in Germany in 2011 as a futuristic project, part of the strategy of which is developing in the field of high technologies that have been accepted by business, science and politicians.

Relevance of Research

The relevance of this research lies in the fact that in the context of the development of the Fourth Industrial Revolution, deep and systemic transformations are taking place, which act as the driving forces for changing paradigms (concepts, models, theories), which give rise to new megatrends of the digitized society, called digital. Big data, the Internet of Things, smart cities,

3D printing and 3D production, bitcoin, blockchain are developing. Advanced technologies contribute to the achievement of well-being, but this requires at least a geometric progression of the economy, business, society, and a change in work and communication paradigms. There are no doubts about the positive aspects of the digital revolution, although advanced technologies are turning into risks for global security, the emergence of criminal corporations, terrorist organizations, which indicates the reverse side of technological innovation. The history of the development of the Fourth Industrial Revolution began at the moment when digital technologies created revolutionary new ways of connecting products and services, resulting in the formation of a smart hybrid — bit (algorithm) that transformed the world. As a result of the fact that humanity sought universal connection to the Internet (world brain), digitization transformed both the world and the person himself.

The world closely interacting with digital technologies has received many benefits thanks to advanced technologies, which require the formation of the concept of digital economic development (Walton & Nayak, 2021). Thus, many countries, in particular, Indonesia and the Philippines, have a great chance to make a breakthrough in the economy under the conditions of the Fourth Industrial Revolution: there are smart leaders, a high population, relatively low external debt, low incomes and low or average expectations of investors. The European Union is considered a stabilizing model and serves as a source for its members, particularly Poland and the Czech Republic, which have breakthrough potential. One of the members of this unique group - South Korea - is considered an industrial giant in the latest technologies and expands the framework of export-oriented economies. “South Korea has moved into the category of countries that can be considered an economic miracle, and next to it there are countries with real potential (Sri Lanka, Nigeria), as well as countries whose hopes are considered personal (Vietnam),” - notes Ruchiro Sharma (Voronkova & Nikitenko, 2022).

Research Methodology

To analyze the formation and development of digital technologies, we will use a non-linear methodology of complexity, which represents a set of theoretical and practical knowledge, abilities, skills and competencies of understanding the digital world, which develops new digital management thinking and new approaches to understanding the existence of a person, his consciousness, worldview, perception of this world. Various methods were used in the basis of the research, which allowed to analyze such a complex topic as society 5.0. One of the methods is the Agile method (flexible philosophy method), which tries to explain the evolution of the digital paradigm of the economy, society and man from 4.0 to 5.0, which should become adaptive, stable, efficient, and intelligent. Philosophers of different eras and schools of thought have tried to reveal the essence of mind, but the question of mind remains relevant to this day, stimulating new research and debate. It is no coincidence that Oleg Maltsev and Iryna Lopatiuk (2023) also returned to this topic. After all, the mind is the tool we use to understand the world around us, which can also be our greatest limitation (Ernest Holmes). The mind can be an objective means of knowledge, the main principle of the development of history and the world (Christian & Griffiths, 2016).

Examining the digital society facilitated by 5G technology entails a comprehensive evaluation encompassing technical attributes, as well as social and economic implications. The following are fundamental approaches for analyzing the 5G society:

1. Technical Analysis – Bandwidth and Data Rate: Evaluating the data transmission capacity concerning preceding technologies.
2. Low Latency: Scrutinizing how 5G diminishes data latency, a critical factor for real-time applications such as autonomous vehicles and remote surgery.

3. Connectivity Density (Massive Device Connectivity): Assessing the extent to which 5G can accommodate a large number of devices, a pivotal consideration for the Internet of Things (IoT).
4. Social Analysis – Impact on Education and Healthcare: Examining how 5G can enhance accessibility to education and healthcare through remote consultations and training.
5. Work and Business: Investigating the influence of 5G on work methodologies and business processes, leveraging improved connectivity and remote work capabilities.
6. Economic Analysis – Economic Impact: Exploring how the deployment of 5G can impact economic growth by fostering new business models and increasing productivity.
7. Investments and Costs: Evaluating the expenses associated with 5G deployment and the necessary investments for infrastructure upgrades.

The analysis methods yielded the following characteristics of the 5G society:

1. High Data Rate: The 5G society offers a significantly higher data rate compared to previous network generations.
2. Low Latency: The 5G society reduces data transmission latency, making it suitable for real-time applications like virtual reality and autonomous vehicles.
3. Connectivity Density: Capable of serving a large number of devices, crucial for the Internet of Things where numerous devices need simultaneous network connection.
4. Energy Efficiency: The 5G society aims for increased energy efficiency, vital for network resilience and broader coverage, including remote and sparsely populated areas.
5. Device Variety Support: Designed to support various devices, ranging from smartphones to IoT sensors and industrial equipment.
6. Security: The level of security provided by 5G and its ability to protect data compared to previous technologies should be considered, including potential vulnerabilities and methods to overcome them.
7. Spectrum Efficiency: Determines how efficiently the 5G radio spectrum is utilized, crucial for eliminating conflicts with other technologies.

An integrated approach is required for analyzing a digital society based on 5G, considering technical, social, and economic aspects:

- Environmental Analysis: Evaluating the environmental implications of 5G deployment, encompassing aspects like energy consumption and overall environmental impact. Considering possible measures to mitigate any adverse effects.
- Regulatory Framework Examination: Investigating the regulatory framework associated with 5G deployment, exploring its impact on various facets such as competition, innovation, and data privacy.
- Adaptation of Society: Assessing how society adapts to the new opportunities and challenges presented by 5G. Evaluate the need for training and skills development to effectively utilize the new technologies.
- Sociocultural Influences: Analyzing how 5G is shaping sociocultural trends, considering changes in societal perceptions, relationships, and communication driven by increased connectivity.
- Interoperability Assessment: Evaluating the level of interoperability of 5G with other technologies and standards. This is crucial for creating compatible and efficient systems.

Analyzing 5G and its impact on society involves a comprehensive consideration of factors, including technical, social, environmental, and political aspects. An integrated approach to assessing these factors will aid in understanding both the positive and negative aspects of 5G deployment in the digital society.

Research Results

On July 14, the 1st All-Ukrainian conference “Industry 5.0” was held in Kyiv (Ukrainian Cluster Alliance, 2023). The organizer of the conference is the Association of “Industrial Automation Enterprises of Ukraine” with the support of the Ukrainian Cluster Alliance. The event took place as part of the Swiss-Ukrainian project “Strengthening MSME Business Associations in Ukraine (Phase II)”, implemented by the United Nations Development Program in Ukraine (UNDP) together with the Ministry of Economy of Ukraine and with the support of the Swiss government. As part of the conference, the participants signed the Manifesto on Ukraine’s transition to Industry 5.0. It is noted that the Manifesto on Ukraine’s transition to Industry 5.0 (signed on July 14, 2023) is a fundamental and guiding document for the further development of Ukrainian manufacturing and hi-tech sectors in Industry, Energy, Infrastructure and Logistics. In certain provisions, such as governance 5.0 and the circular economy, we are talking about all real sectors of the economy. This document replaces the Industry 4.0 Charter of 2016 and significantly complements the Industry4Ukraine Manifesto of 2019. Conference participants call on other business associations, government organizations, scientific and educational institutions, public organizations to join the signing.

The transition to Industry 5.0 in many directions is possible without a gradual, consistent passage through 3.0 (full automation of production) and 4.0 (digital transformation as a change in business models through the use of modern technologies such as artificial intelligence and the Internet of Things). It is about changing the industrial paradigm of industrialists and policy-makers at various levels, where the principles of sustainable development, stress resistance of value-added chains and ecosystems, orientation to the needs of society, circular economy, and fair distribution of profits begin to dominate the basis of decisions. According to such approaches, technology is simply a tool for achieving the goals of sustainable development, and this is a fundamental difference from the approaches of Industry 4.0, where the predominant focus was on improving the competitiveness and profitability of enterprises due to the use of new technologies. Conference participants agreed that Ukraine has great potential for the transition to Industry 5.0, primarily due to factors such as a passionate and creative society, scientific, technical and educational potential, developed startup communities, thousands of qualified developers and integrators. That is why we chose for analysis the topic of the evolution of the digital paradigm of the development of the economy, society and man from 4.0 to 5.0 (Ukrainian Cluster Alliance, 2023).

1. Conditions for the Emergence of Society 5.0

The digital worldview is formed in the context of the development of digital processes, which change as a reaction to the trends of globalization 4.0, technological development 4.0, Enlightenment 2.0, and influence the emergence of new directions of digital management, digital economy, Internet economy, sustainable development economy, future economy, emergence of the post-world and posthumans. “The development of digital technologies is developing so rapidly that in the near future we will see the development of remote identification, biometric technologies, transactional products and services” (Volkov et al., 2017).

Looking at current political priorities at the European level, their impact on industry cannot be underestimated. The Green Deal will call for a transition to a circular economy and greater reliance on sustainable resources, including energy. Europe offers enormous potential for innovation. A revitalized European Research Area (ERA) will connect and drive research and innovation in Europe, while a new European Industrial Strategy and Skills Agenda aim to address skills shortages. The COVID-19 crisis has highlighted the need to rethink existing methods

and approaches to work. This exacerbates our industry's vulnerabilities, such as fragile strategic value chains, and dramatically increases the need to search for flexible and robust innovations to address these vulnerabilities (Voronkova et al., 2021).

It should be emphasized that Industry 5.0 should not be understood as a chronological continuation or replacement of the existing Industry 4.0 paradigm. It is the result of visionary work, a way of structuring how European industry and new social trends and needs will coexist. Industry 5.0 complements and expands the excellent capabilities of Industry 4.0. It highlights some aspects of the determining factors determining the place of industry in the European societies of the future; these factors are not only economic or technological in nature, but also have important environmental and social aspects. The concept of "Industry 5.0" contributes to increasing the economic efficiency of the industry while respecting the needs and interests of employees and ensuring environmental sustainability. This makes it attractive not only to entrepreneurs, but also to potential investors and consumers who could benefit from a more competitive offering in a broader sense.

Participants from research and technology organizations and funding agencies from across Europe discussed the concept of the 5G Industry in two virtual workshops organized by DG Research and Innovation Prosperity on 2 and 9 July 2020. The focus is on implementing 5G technologies to support industry. The participants agreed on the need for more effective integration of Europe's social and environmental priorities into technological innovations and the removal of emphasis from individual technologies to a systemic approach. Six categories were identified, each of which is considered to use its potential in combination with others as part of the technological structure: 1) personalized human-computer interaction; 2) biotechnology and intellectual materials; 3) digital duplicates and simulations; 4) data transmission, storage and analysis technologies; 5) artificial intelligence; 6) energy efficiency, renewable energy sources, storage and autonomous technologies (Voronkova & Nikitenko, 2022).

Industry 5.0 originates from the concept of "Industry 5.0", which was proposed in Germany in 2011 as a futuristic project and part of the country's high-tech strategy, which should be widely accepted by business, science and politicians. Initially, it was concerned with how and to what extent the country succeeded in the first decade of the 21st century and how to more effectively maintain largely stable manufacturing employment in the coming decades. Professor Klaus Schwab has published two books in which he describes how Industry 4.0 fundamentally differs from previous industrial concepts characterized by technological progress (Voronkova et al., 2023).

The term has international influence and is used in various ways by think tanks, business leaders, international organizations and politicians. In its decade-long history, Industry 4.0 has moved away from the original principles of social justice and sustainability and focused more on digitization and artificial intelligence-based technologies to increase production efficiency and flexibility. The concept of Industry 5.0 offers a different focus and emphasizes the importance of research and innovation to support industry in providing long-term services to humanity on a global scale (Barata & Kayser, 2023; see also Agrawal et al., 2023; Leng et al., 2023; Mourtzis et al., 2022; Tóth et al., 2023).

The concepts of "Society 5.0" and "Industry 5.0" are related, as both concepts belong to a fundamental shift in our society and economy to a new paradigm (Huang et al., 2022). The concept of "Society 5.0" was proposed by Japan's most important business association, Keidanren, in 2016. He was later supported by the Japanese government. Japan basically incorporates levels of digitization and transformation (mainly at the level of individual organizations and parts of society) into a full national transformation strategy, policy and even philosophy ("Japan Pushing Ahead With Society 5.0 to Overcome Chronic Social Challenges," 2023).

Simply put, it is a new type of society compared to the hunting society (Society 1.0), the farming society (Society 2.0), the industrial society (Society 3.0) and the information society (Society 4.0). The basic plan of science and technology in 2016 - as a social goal that Japanese society should achieve in the future. In particular, it is defined as the introduction of the latest technologies such as the Internet of Things (IoT), robots, artificial intelligence (AI) and big data

into all industries and social life, promoting innovation and maintaining standards. The form that people need to solve social problems is this new type of society, society 5.0. Undoubtedly, there are many academic papers and studies devoted to this topic (Bartoloni et al., 2022; Calp & Bütüner, 2022; Del Giudice et al., 2023; Fukuda, 2020; Nagy et al., 2020).

This concept was first proposed by the Japanese government in the Fifth Science and Technology Basic Plan in January 2016. The goal is to understand that Japanese society will lead the world and reach a new level of society. Its main concept is to develop the economy and solve social problems in parallel through a highly integrated system of imaginary and real spaces to achieve a new type of people-oriented society.

In the information society (Society 4.0), which existed before, knowledge and information cannot be completely separated, and vertical cooperation between different areas is insufficient. Due to the limited capabilities of a person, it is difficult for a person to find and analyze the necessary information from various information sources, or due to age and physical disabilities, some types of work and actions are limited. At the same time, there are many social problems that are difficult to solve due to the problems of declining birth rates and problems of aging in Japanese society and the sparse population of the area (“Japan Pushing Ahead With Society 5.0 to Overcome Chronic Social Challenges,” 2023)

2. Characteristics of Society 5.0

In this regard, Society 5.0, which will be implemented in the future, should connect all people and objects through the Internet of Things (IoT), achieve the exchange of various knowledge and information intelligence, and also create unprecedented new values, to overcome and solve the abovementioned problems (Valette et al., 2023; see also Kassab & Darabkh, 2020; Rezaee et al., 2023). The Internet of Things is a rapidly developing field, which reflects the current scientific research (Gao et al., 2023; Lu et al., 2018; Tabaa et al., 2020; Voulgaridis et al., 2022; Yang, 2023). In addition, artificial intelligence (AI) will provide people with the information they need when they need it, and technologies such as robots and self-driving cars will also help solve problems through innovation, society will overcome previous barriers and become a society in which people can hope and respect each other regardless of gender, age or age, and a society in which everyone can develop their abilities without hindrance.

Society has passed the following stages in the direction of a super-intelligent society (Society 5.0): a hunting society (Society 1.0), an agricultural society (Society 2.0), an industrial society (Society 3.0) and an information society (Society 4.0). A people-centered society that balances economic development and solving social problems through a system that closely integrates cyberspace and physical space. In the information society (Society 4.0), cross-industry exchange of knowledge and information is not enough, and cooperation is difficult. Since human capacity is limited, the task of ascertaining and analyzing the necessary information from excessive information sources is burdensome, and the work and scope of action are limited by differences in age and ability. In addition, it is difficult to adequately cope with various limitations from such problems as declining birth rates and aging of the population, decline of the local population (Government of Japan, 2022).

Social reform (innovation) in Society 5.0 will enable the implementation of a progressive society that destroys the existing sense of stagnation, a society in which members respect each other and transcend generational boundaries, and a society in which everyone can lead an active and enjoyable life. Society 5.0 has achieved a high degree of integration of cyberspace (virtual space) and physical space (real space).

In the past information society (Society 4.0), people accessed cloud services (databases) in cyberspace via the Internet to search, retrieve and analyze information or data. In Society 5.0, a large amount of information from sensors in physical space accumulates in cyberspace. In cyberspace, this big data is analyzed by artificial intelligence (AI), and the results of the analysis are communicated to people in physical space in various forms. In the past, it was a common

practice in the information society to collect information over the network and analyze it by humans. However, in Society 5.0, people, things and systems are interconnected in cyberspace, and the best results achieved by artificial intelligence beyond human capabilities return back to physical space. This process brings new value to industry and society in an unprecedented way.

Society 5.0 balances economic development and solves social problems. It is safe to say that the environment in Japan and in the world is experiencing an era of rapid change. With the development of the economy, prosperity and convenience of life, the need for energy and food products increases, life expectancy increases, and an aging society moves forward. In addition, the process of economic globalization continues to develop, international competition is becoming increasingly fierce, and problems such as the concentration of wealth and regional inequality are becoming more and more visible. The social problems that must be solved (as a trade-off) for this economic development are becoming increasingly complex. Various measures are needed here, such as reducing greenhouse gas (GHG) emissions, increasing production and reducing food losses, and reducing costs associated with an aging society. In the face of such great changes in the world, new technologies that can affect social processes, such as the Internet of Things, robots, artificial intelligence and big data, continue to develop. Japan aims to implement Society 5.0, a new society that incorporates these new technologies into all industries and social activities, while ensuring economic development and solving social problems (Government of Japan, 2022).

Over the past few years, thanks to the rapid development of technology, countries have formulated new national concepts of development. The United States calls for "recovery", Germany promotes "Industry 4.0", and China unveils "Made in China 2025" (Digital Transformation Monitor, 2017; United States Chamber of Commerce, 2017). Only Japan offers a human-centered development concept, with an emphasis on economic and technological development that must simultaneously solve human social problems. In line with human-centered thinking, Japan proposes Society 5.0 in 2030. This is the fifth transformation of human society after hunting, agriculture, industry and the information society. It is a super smart society based on artificial intelligence, robots, IoT and quantum technologies. According to the Society 5.0 plan, people will live in a world where online virtual and physical reality are integrated; people and robots will coexist in symbiosis; life, be it study, work or leisure, will no longer be linear. For example, human mobility will increase efficiency, reduce accidents and solve the mobility problems of the elderly through autonomous driving and instant messaging technology ("Japan Pushing Ahead With Society 5.0 to Overcome Chronic Social Challenges," 2023).

3. Differences of Society 5.0 From Previous Types of Society

In the concept of "society", the way people make a living is directly related to the way they build their society. The number "5" originated on a completely different timeline than the Industrial Revolution, and on a much longer timeline. The first two "societies" correspond to the pre-industrial period (until the end of the 18th century) and are associated with hunting and gathering and agriculture, respectively. The 3G society is an industrial society that more or less corresponds to the periods of the first, second and third industrial revolutions.

The 4G society is characterized by the dominance of "information", it can be said that it has evolved from the highly digital version of the third industrial revolution to the present. Society 5.0 tries to balance economic development with solving social and environmental problems. It is not limited to the manufacturing sector, but solves larger social problems based on the integration of physical and virtual spaces. Society 5.0 is a society in which advanced IT technologies, IoT, robotics, artificial intelligence and augmented reality are actively used in everyday life, industry, health care and other fields of activity not for economic gain, but for the common good and convenience of citizens. Despite claims that digital technologies are developing at an exponential rate and are becoming increasingly disruptive in nature, the adoption of digital technologies in European industry appears to be more gradual (Goodman, 2016).

While specific new technologies may enable new, disruptive approaches, they are fragmented

into many smaller players (without digital skills or investment capabilities). This can be achieved through the large infrastructure investments required in some types of industries, so the current adoption of digital technologies in European industry is linear rather than exponential, incremental rather than disruptive. In general, the technological landscape of European industry is diverse: from modern high-tech production lines to small enterprises that still keep records of customers in paper directories. A growing number of projects focus on the human and social aspects of the digitization of our (industrial) workplaces, thus promoting a human-centered view of Industry 5.0. A number of projects explore the interaction of humans with robots and cobots in production, explore ways to benefit from their strengths, and ways to assess human capital. Another set of projects examines the impact of digitization on the future of work and the well-being of individuals and society as a whole. The skills needed by workers are an important aspect in analyzing the prerequisites for a successful transition to the 5G Industry and are addressed in several Horizon 2020 and Erasmus projects aimed at closing skills gaps and adaptive learning. Finally, and more importantly, these projects investigate the impact of digital work environments on worker safety, working conditions, job satisfaction, and physical and mental health (eg, human production, symbiosis). It should not be considered exhaustive, as several other Horizon 2020 projects touch on Industry 5.0, innovative technologies (artificial intelligence, photonics, smart materials), green economy and sustainable or experience and skills development (Gupta, 2018).

Although Industry 5.0 is a relatively new concept, some early scientific papers describe its main features. An analysis of the literature on Industry 5.0 shows that there is a lot of uncertainty about what it will bring, how it will interfere with business in detail, and what is its ability to break down the barriers between the real world and the virtual world. Based on the literature review and our perspective analysis, we argue that Industry 5.0 is defined as the rediscovery and expansion of purpose beyond the production of goods and services for profit.

- This society of the future “5.0” consists of super-intelligent systems in six main areas. **The** first is drone delivery. The Japanese government believes that one of the main problems facing a society with a low birth rate is that lonely and widowed elderly people in remote areas remain abandoned by society. To solve this problem, drone delivery can not only ensure the speed of logistics, but more importantly, it can provide the most convenient delivery service for people who live in remote areas with inconvenient transportation (Lee, 2018).
- Secondly, the popularization of home appliances with artificial intelligence. Not only can air conditioners, hot water in the bathroom, rice cookers, microwave ovens and other household appliances be controlled remotely, you can use your smartphone to give instructions. At the same time, refrigerators will be completely intelligent, what is missing?
- Third, intelligent medical care and patient care. With the help of the artificial intelligence system, remote diagnosis and treatment can be carried out. At the same time, highly intelligent robot nurses were produced, allowing paralyzed patients to take care of themselves. Create a highly intelligent robot companion to ease the loneliness of the elderly or patients. According to the Japanese government’s goals, this remote monitoring system can not only detect people’s blood pressure, but also detect data such as blood sugar and uric acid levels using smart toilets, as well as check for cancer in feces and urine.
- Fourth, intelligent and automated industries. For example, with the help of a GPS positioning system, it is possible to implement fully automated operation of agricultural machinery, as well as to implement unmanned operations for transplanting, harvesting and transportation. The technology of planting vegetables and the experience of agricultural experts or veteran farmers are introduced into the intelligent system, and then the inorganic cultivation of fruits and vegetables is happening indoors, and the safest and most nutritious fruits and vegetables that are completely close to growth are grown naturally.
- Fifth, intelligent management. Electronic payments will become the mainstream of social payments. With the help of an electronic payment system, a huge database can be created, which can organize the supply of goods in a more targeted manner, expand production and link with intelligent logistics for automatic distribution and replenishment. Hotels

and resorts can use facial recognition technology to provide more convenient services for residents and at the same time significantly save on personnel management costs, making travel more comfortable.

- Sixth, fully automatic driving. By implementing fully automatic driving and reducing traffic accidents to zero, we will create a "car sharing" society through an online car ordering system. Fully automated buses can provide travel services to people 24 hours a day. Even in remote villages or when returning home late at night, driverless buses can provide the most convenient and uninterrupted service. Children go to school, elderly people go out, driverless buses will become people's life companions.

The logistics of the super-intelligent society will be more developed, and the volume of goods delivery will also increase, while the logistics industry will also experience a serious labor shortage. Delivery trucks with a fully automatic driving function will use high-speed information transmission and communication between trucks. If there are 10 delivery trucks, while the first truck is driven by someone, the next 9 trucks form a team.

Thus, the Internet of Things (IoT), big data, artificial intelligence and robotics will become the basis of the implementation of "Society 5.0". To implement Society 5.0, the Japanese government's Institute of Advanced Industrial Technology has proposed six key technologies that must be fully overcome:

1. Human intelligence augmentation technology capable of controlling perception in the CPS system.
2. Innovative artificial intelligence technology and applied artificial intelligence system.
3. Self-Evolving Security Technology for Artificial Intelligence Applications
4. Information input and output equipment and effective network technologies.
5. A new generation of technologies of intelligent production systems supporting mass customization.
6. Completely new measurement technology for the production of intelligent products. Therefore, the concept of a system of free flow of data based on trust (Data Free Flow with Trust), which is "society 5.0", should be developed. The trend of the Japanese government building "Society 5.0" deserves our long-term attention.

Discussion

Formation of the Concept of Industry 5.0

The concept of Industry 5.0 is moving forward at an incredible speed due to digitalization combined with the growing possibility of microprocessor computing power, telecommunication networks and the addition of new nodes to networks, which will contribute to the improvement of electronic services with the presence of basic digital infrastructures. The concept of Industry 5.0 in the context of exponential development is particularly focused on the breakthrough technologies presented by Martin Stutchi. At its core is the great benefit of big data for the energy transition to a circular economy and for the recovery of valuable resources. However, as the sources note, the potential of disruptive (breakthrough, digital) technologies in the interests of sustainable digital development has not yet been fully implemented, because Agile management has not been implemented as a factor of flexible breakthrough technological development (Mason, 2015).

At the heart of the Concept of Industry 5.0 are the philosophical principles of digital information and computer technologies that develop on the border of various sciences: philosophy, computer science, software, high (breakthrough, digital, convergent, innovative, socio-humanitarian) technologies that affect sustainable development in the context of the formation of the following developments: 1) artificial intelligence; 2) robotics; 3) control systems of industrial equipment via the Internet; 4) unmanned vehicles; 5) 3D printing; 6) nanotechnology; 7) biotechnology; 8) materials science; 9) quantum computers.

Philosophers need to prove exactly how digital technologies will change life and the lives of future generations and what changes will take place in the economic, social, spiritual, and cultural spheres. “The concept of digital sustainable development, which is changing in the conditions of digitization and exponential growth, is especially focused on breakthrough technologies” (Meadows et al., 2004). It is presented by Martin Stutchi, and it is based on the analysis of big data for the energy transition to a circular economy and especially for the recovery of valuable resources.

The concept of Industry 5.0 as a global trend of informatization, digitization and technological production will lead to changes that will be able to contribute to endless digital transformations in the interweaving of the physical, digital and biological worlds. Digital technologies themselves are changing management processes, as innovative products (cryptocurrencies, blockchain, fintech), megatrends of the digital era are emerging, which are creating conditions for a sustainable economy at an incredible speed. In contrast to the old management processes, automation, robotics, new possibilities of business processes appear, the human potential is revealed. Everyone must adapt to the speed of change and achieve sustainability: enterprises, companies and organizations, statesmen, citizens. The speed of changes leads to the fact that digital production begins to depend not on material assets, but on digital technologies, which are based on “the intellectual component, organizational and human capital, the synergistic essence of digital spheres that contribute to the globalization of the world” (Nikitenko et al., 2021).

The formation of the concept of Industry 5.0 in the context of the challenges and threats of the digital world, as a global trend of the digital society, will contribute to drastic, large-scale changes that will lead to quantum computing. Nanotechnology replaces established production methods and radically changes the market, as it is a breakthrough product that creates a new industry aimed at creating conditions for a sustainable society. A breakthrough in many areas has already taken place. Thus, thanks to quantum computers, we are solving tasks that we cannot even approach yet, and this includes a whole class of operations that would take hundreds of years for the fastest computers. The computing power of ordinary computers continues to blossom every 30 years and doubles roughly every year and a half. “This regularity is called Moore’s Law,” notes O’Reilly Tim in “Who Knows What Our Future Will Be” (Gupta, 2018). Digital progress is achieved due to the miniaturization of the transistors that make up the processor. The picture seems encouraging, but individual operations are so complex that even the best computers at the moment will calculate the correct answer for a long time. What are these tasks? Forecasting the weather, calculating the most useful stock investments, the fastest route for a courier with several deliveries. A quantum computer will be able to give an answer immediately, it opens up new possibilities for humanity (Nikitenko et al., 2019).

The formation of the concept of Industry 5.0 in the context of challenges and threats of the modern world, as a global trend of the digital society, is connected with the fact that we live in the era of big data. Research shows that millions cannot imagine their lives without mobile technology and are much more interested in distributed energy technology like solar panels than previous generations, and therefore welcome advanced energy technologies. “The formation of the concept of sustainable digital development is already taking place in many areas and represents a significant factor of progress,” notes Michael Spence (2011).

In the future, artificial intelligence will be everywhere: in courtrooms, offices, homes for the elderly, and marriage agencies. For the development of the concept of the economy of sustainable digital development, which is non-state-creative, the state should be the main source of funding for the development of scientific, technical and innovative activities, an important factor for increasing innovation. It is obvious that the economy of Industry 5.0 cannot take place without the help of the state. Today, such an economy permeates all spheres of life in society: from demography, the biosphere and climate change to the future of medicine, genomics and genetic engineering, synthetic biology and transhumanism; from cloud technologies and the Internet of Things to artificial intelligence, quantum computing (Nikitenko et al., 2022).

The concept of Industry 5.0 means reducing energy consumption and greenhouse gas

emissions, preventing depletion and degradation of natural resources, and meeting the needs of the present and future generations without harming future generations. Technologies such as artificial intelligence and additive manufacturing can play an important role in optimizing resource efficiency and minimizing waste.

From a technology perspective, Industry 5.0 tries to utilize the prospects of advanced digitization, big data and artificial intelligence, while highlighting the role these technologies can play in meeting new and urgent needs in the industrial, social and environmental landscapes.

Mechanism of Implementation of the New Model of Society 5.0

Society 5.0 will be implemented through a highly integrated system of imaginary space and real space. The previous information society 4.0 was created by people who use the Internet to access cloud services (databases) that existed in virtual space to obtain information or data and analyze them (Oleksenko & Harbar, 2022).

In "Society 5.0", sensors in real space accumulate a large amount of information in virtual space. Artificial intelligence (AI) analyzes the big data generated in this way in the virtual space, and the results of the analysis are brought back to life in the real space in various forms. In the previous information and intelligence society, people analyzed information to create value, but in the future society 5.0, artificial intelligence (AI), surpassing human capabilities, will analyze huge big data, and the results will be transmitted to robots and returned to people, thereby bringing new value to industry and a society that did not exist before.

Currently, Japan and the entire world are experiencing a period of great environmental change. With the development of the economy, people's lives become convenient and saturated, the demand for energy and food products increases, and life expectancy increases, which leads to the development of aging in society. At the same time, due to the globalization of economic development, international competition is intensifying, which leads to such problems as excessive concentration of wealth and uneven development between regions. These social problems, which are incompatible with economic development and require urgent solutions, are becoming increasingly complex, such as reducing the amount of exhaust gases (GHG) that cause global warming, increasing food production and reducing waste, and controlling social costs. Due to the problems of aging population, promotion of sustainable industrialization, redistribution of wealth and regional disparities, all these need to be solved. However, the former social system could not simultaneously develop the economy and solve social problems and found itself in a very difficult situation (Oleksenko, 2017).

The implementation mechanism of the new 5G model includes a number of technical and organizational steps, which include the following areas of digitalization development:

1. **Standardization:** various standardization organizations, such as the International Telecommunication Union (ITU) and the 3rd Generation Partnership Project (3GPP), develop technical requirements and specifications for 5.0.
2. **Infrastructure:** The implementation of 5.0 requires the deployment of new infrastructure, which includes the installation of new base stations that support 5.0 technology, as well as the upgrade of network equipment and data transmitters.
3. **Planning:** This stage involves the analysis of needs and opportunities, the development of a 5.0 implementation strategy and the determination of the necessary resources. Factors such as coverage, capacity, security, budget, etc. are considered in this process.
4. **Network deployment:** Telecom operators are installing new equipment and infrastructure to deploy the 5.0 network. This may include installing new base stations, laying fiber optic cables and configuring network elements.
5. **Testing and Optimization:** After the network is deployed, testing is done to verify functionality and performance. Telecommunications operators perform network optimization to ensure quality of service and optimal performance.

6. Implementation of services: the implementation of management 5.0 includes a number of processes and mechanisms that help ensure the effective use and management of this technology.
7. Deployment: This process includes the installation of base stations, equipment configuration, testing and implementation of network infrastructure solutions.
8. Configuration: After the physical deployment comes the network configuration phase. It covers setting up network parameters including frequencies, channels, bandwidth. Configuration depends on user needs and network requirements.
9. Monitoring and management: This mechanism includes supervision and management of the operation of the 5.0 network. This can be done using a Network Management System (NMS) or other software that provides service level monitoring, problem detection, service recovery, and network optimization.
10. Spectrum resources: Adequate spectrum resources are required for the implementation of 5.0. Governments and regulatory bodies conduct frequency spectrum auctions or set aside certain bands for use by 5.0 operators.
11. Optimization: This process involves implementing strategies and methods to improve performance and service quality (Oleksenko, 2013).

The 1st All-Ukrainian Conference “Industry 5.0” (Kyiv, 2023) came to the following recommendations:

- “Leap through 3.0 and 4.0” — paradigms about “transformations and revolutions” need to be changed. The potential in the transition to 5.0 exists, but is quickly exhausting.
- Governance 5.0 — the 1st step to this is the creation of the State Agency of Smart Industries (Oleksenko, 2015a).
- The problem of the double transition (digital and green) of Ukrainian SMEs does not depend only on the weakness or absence of state institutions. The outdated paradigms of the industrial structure (3.0) of most industrialists are also obvious and it is time to change.

At the same time, we welcome the strong consolidation of industrialists, government structures, parliament and business associations regarding the priority of the processing industry as the engine of Ukraine’s economy during the Recovery period. Now we need to include the future tools and mechanisms that can really make our sectors smart (Oleksenko, 2015b).

The resolution offers a list of 8-top double transition tools for manufacturing SMEs, which are practically absent in Ukraine today. Rapid consolidation with the help of donors and the international community is needed for their creation and launch.

The lack of these tools and strong state institutions is direct. There is a direct reason for the weak contribution of innovative industrial ecosystems to the strengthening of the defense industry and complete dependence on Western arms supplies. The resolution draws the attention of all state structures to their direct responsibility for this state of affairs.

Conclusions

Society 5.0 cannot simply be a science and technology policy that will affect the entire Japanese society and should be considered as a national strategy. Using new values to achieve economic development and solve social problems through technological innovation will eliminate differences in regions, age, gender, language, etc., which will allow flexible response to current and potential needs (O’Reilly, 2017).

Products and services will be provided to the people who need them, in the right amount, when they are needed, and the social system will also be optimized to become a society in which economic development and social problems can be solved in parallel. Of course, the implementation of such a society is accompanied by various difficulties, but the Japanese government is determined to bravely overcome and challenge the difficulties, lead the world as a pioneering country, and show the world a model of the future society (Spence, 2011).

Areas of application of new values — transport, medical care, production, agriculture, food, prevention of natural disasters, energy. Society 5.0 is a people-oriented society. The previous society was a society that prioritized economic and organizational systems.

The future society (Society 5.0) will replace and support operations and adjustments previously performed by humans based on big data with the help of AI and robots, so that humans will be freed from daily complex and inconvenient labor operations, and everyone will lead a comfortable, energetic and high-quality life. It will be a human-centered society with every member of society at its center, not a future society dominated and controlled by AI and robots.

At the same time, this kind of society will lead to the solution of various problems in the world, which lead to the solution of the goals of sustainable development (Sustainable Development Goals: SDG), proposed by the League of Nations. An example is Japan, which implements advanced technologies in all fields and aspects of social life, creates new values through technological innovation, and leads the world towards implementing a human-centered society (Society 5.0), where everyone can live comfortably, energetically, and with high standards (Studwell, 2013).

The concept of industry 5.0 refers to the need to increase the degree of reliability of industrial production, making it more resistant to failures and ensuring its ability to provide and maintain critical infrastructure during a crisis. Political changes and natural crises such as the COVID-19 pandemic have highlighted the fragility of current globalized production methods. This process must be balanced by developing strategic value chains with sufficient resilience, adaptable production capabilities and flexible business processes, especially where the value chain serves basic human needs such as health or safety (Schwab, 2017).

The concept of Industry 5.0 is an open and evolving concept that provides a basis for the further development of the concept of cooperation and co-creation for the industrial future of Europe. Digital technologies will play a special role. While digital interconnectivity will enable a range of sustainable technologies (including data collection, automated risk analysis and automated remediation), the growing reliance on digital technology exposes the industry to technical challenges caused by disruptions and cyber-attacks. Research and innovation will play a key role in developing the cybersecurity required for future sustainable industries. The concept of Industry 5.0 is: human orientation.

The introduction of 5G technology presents significant opportunities for enhancing various aspects of society. Here are practical recommendations for the optimal utilization of 5G technology:

1. **Infrastructure Development:** Investing in the development of high-speed wireless infrastructure to ensure widespread 5G coverage. Fostering collaboration among government agencies, telecom companies, and other stakeholders to facilitate efficient network deployment.
2. **Data Security:** Developing and implementing stringent data security standards to safeguard sensitive information transmitted over 5G. Encouraging cybersecurity research to proactively address threats and potential attacks on the 5G network.
3. **Internet of Things (IoT) Industries:** Supporting and fostering innovation in the IoT sector by leveraging 5G to provide reliable connectivity between devices. Exploring applications of IoT in various sectors such as healthcare, transportation, agriculture, and smart cities.
4. **Education and Training:** Integrating 5G technology into educational programs to equip students with new digital skills. Promoting research and innovation on 5G technology at universities and research centers.
5. **Transportation and Safety:** Utilizing 5G technology to establish intelligent transportation systems, enhancing traffic safety and efficiency. Implementing autonomous and unmanned vehicle systems, relying on 5G capabilities for fast data transfer.
6. **Energy Saving:** Applying 5G technology to optimize energy consumption in smart cities and buildings.
7. **Partnerships:** Fostering collaborations between government agencies, private companies,

and public organizations to jointly develop and implement projects using 5G technology. These recommendations can serve as a foundation for the effective implementation and utilization of 5G technology in society, contributing to innovation, improvement of quality of life, and the development of various industries.

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