



FUTURE TECHNOLOGIES AND A NEW STAGE OF TECHNICAL DEVELOPMENT

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<https://doi.org/10.5281/zenodo.19045631>

Abstract: This article comprehensively examines the issues of future technologies and the new stage of technical development. It analyzes the historical formation of technological progress, the impact of modern technologies on social life, and their prospective development directions. In particular, the current significance of artificial intelligence, robotics, information and communication technologies, and environmentally oriented technical solutions is considered based on scientific sources. Furthermore, the relevance of technological progress is substantiated in connection with global challenges, economic development, and the improvement of human quality of life. Relying on the works of prominent scholars and thinkers, the article also explores the social and cultural aspects of technological development. The results of this study contribute to a deeper understanding of the role of future technologies in the advancement of society.

Keywords: future technologies, technological development, artificial intelligence, IoT, quantum computing, cloud technologies, digital transformation, technological progress, Industry 4.0.

1. Introduction

It is difficult to imagine the development of the modern world without technology and technical innovations. Every stage of human history has been closely linked to specific technological achievements that have directly influenced economic, social, and cultural development. In the twenty-first century, technological progress has advanced at an unprecedented pace, marking a fundamentally new stage in technical development. Digital technologies, artificial intelligence, robotics, and automated systems have deeply penetrated nearly all areas of human activity. Today, one of the main scientific challenges is to determine how this new stage of technological development affects society and what consequences it may bring in the future. While technologies contribute to increased productivity, reduced human labor, and improved quality of life, they also generate new social, economic, and ethical issues. Therefore, technological progress should be considered not only as a technical process but also as a complex social phenomenon. The main idea of this article is to scientifically analyze future technologies and the new stage of technical development and to reveal their role in societal progress. The purpose of the study is to identify the key directions of technological development using examples of modern and emerging technologies, to justify their relevance, and to highlight future development trends. Previous studies in this field are also of significant importance. In particular, scholars such as Alvin Toffler, Manuel Castells, and Lewis Mumford emphasized the decisive role of technology in societal development and scientifically analyzed various stages of technological progress. Their ideas serve as a theoretical foundation for a deeper understanding of this topic.

To understand technological development, it is first necessary to analyze its historical and theoretical foundations. Throughout human history, technology has functioned not only as a means of production but also as a key factor shaping societal development. In *Technics and Civilization*, Lewis Mumford analyzes technological progress in close connection with social development, emphasizing that technical innovations directly influence social structures. Mumford divides technological development into several stages. In the early stages, humans relied on simple tools, followed by mechanization. As a result of the Industrial Revolution, machines became the primary means of production. In the twentieth century, electricity, electronics, and automation marked a new stage of technological development. Today, digital and intelligent technologies represent the highest stage of technological progress. This process demonstrates that technology is constantly evolving in response to societal needs and scientific knowledge, creating the foundation for future technologies.

The concept of future technologies is interpreted differently in scientific literature. In *The Third Wave*, Alvin Toffler divides human history into three major stages: agrarian, industrial, and information societies. According to him, the current era is characterized by an information- and knowledge-based society in which technology plays a decisive role. Future technologies are penetrating all areas of social life. Automation in production, digital platforms in education, and AI-based diagnostic systems in healthcare serve as clear examples. These technologies not only increase productivity but also enhance comfort and safety in human life. At the same time, they generate new challenges such as labor market changes, information security risks, and ethical concerns, highlighting the need to study technology from both technical and social perspectives. Artificial intelligence is currently one of the most significant directions of technological development. Stuart Russell and Peter Norvig, in *Artificial Intelligence: A Modern Approach*, define artificial intelligence as an intelligent system capable of perceiving its environment and acting accordingly. AI systems can analyze large volumes of data, learn from experience, and make predictions. In healthcare, artificial intelligence assists in early disease detection and treatment optimization. In finance, it is widely used for risk assessment and fraud detection. In the future, artificial intelligence is expected to become a primary driver of technological development. However, scholars emphasize the importance of human oversight and ethical standards, stressing that AI should ultimately serve human interests.

Robotics is an integral part of technological development. In *I, Robot*, Isaac Asimov philosophically explores the relationship between humans and robots, drawing attention to ethical issues associated with technology. Today, robots are widely used in industry, healthcare, logistics, and service sectors. Automated production systems reduce human labor and significantly increase efficiency, while robots perform dangerous and physically demanding tasks, contributing to human safety. The development of robotics indicates that technological progress has entered a new stage. This process strengthens collaboration between humans and machines and gives rise to new forms of professional activity.

Information technologies form the foundation of future technologies. In *The Information Age*, Manuel Castells emphasizes that digital technologies are fundamentally transforming the economic and social structure of society. The Internet, cloud technologies, and big data have changed the way information is processed and shared. Digital technologies are enhancing efficiency in education, healthcare, and public administration, indicating a qualitative shift in technological development

Future technologies are also aimed at addressing environmental challenges. In *Factor Five*, Ernst Ulrich von Weizsäcker substantiates the need for efficient resource use and the development of energy-saving technologies. Renewable energy sources, electric vehicles, and recycling technologies contribute to environmental sustainability. These innovations represent a new stage of technological development focused on maintaining balance between human activity and nature. One of the key areas requiring special attention in the new stage of technological development is the Internet of Things (IoT). IoT technologies enable devices and systems to communicate via the Internet and exchange data in real time. These technologies are widely used in industry, agriculture, transportation, and healthcare. Smart manufacturing systems use IoT sensors to monitor equipment conditions, prevent failures, and optimize resource use. Cloud technologies also play a crucial role in modern technological development. They enable remote data storage and processing, reducing infrastructure costs for organizations and supporting digital transformation across various sectors. The new stage of technological development is often associated with the concept of Industry 4.0, which involves the full digitalization and automation of production processes through intelligent systems. Within Industry 4.0, artificial intelligence, IoT, robotics, and big data operate in an integrated manner, making production more flexible, efficient, and responsive. Another promising direction is quantum computing. Unlike classical computers, quantum computers use quantum bits (qubits) and can process complex calculations at unprecedented speeds. Quantum computing has significant potential in cryptography, complex modeling, chemistry, and pharmaceutical research. It also raises new challenges in information security, necessitating the development of quantum-resistant cryptographic methods. Thus, quantum computing is becoming not only a technical innovation but also a strategic and security-related technology.

Future technologies are becoming a key driver of economic development. Digital economies, innovation, and technological competition increasingly determine national progress. At the same time, technological advancement leads to the emergence of new professions and the disappearance of traditional ones, requiring adaptability and lifelong learning. Educational systems must evolve accordingly. The new stage of technological development also raises ethical issues, including AI decision-making, personal data protection, and technological inequality. Asimov's laws of robotics highlight the importance of defining ethical boundaries for technological development. Therefore, human values and ethical norms must remain central to the advancement of future technologies.

2. Methodology

Conclusions

This article has scientifically analyzed the issues of future technologies and the new stage of technological development. The study examined the historical evolution of technology, the impact of modern technologies on society, and their future directions. The significance of artificial intelligence, robotics, information and communication technologies, IoT, quantum computing, and environmentally oriented technological solutions was analyzed based on scientific sources.

The findings indicate that future technologies represent a logical and qualitative new stage of technological development. While these technologies enhance productivity, reduce human labor, and improve quality of life, they also generate social, economic, and ethical challenges. Therefore, technological progress must be approached not only as a technical



process but also as a complex social phenomenon. Future research should focus on human-centered implementation, ethical standards, and sustainable development in the advancement of emerging technologies.

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