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Gurin Dmitro¹

¹ senior teacher at Kharkiv National University of Radio Electronics

KEY FEATURES AND DIFFERENCES BETWEEN INDUSTRY 5.0 AND INDUSTRY 4.0

Industrial revolutions play a key role in shaping modern society and its economy. With each new stage of technological change, industry has undergone significant transformations that have affected not only production processes but also society as a whole. In the 21st century, these changes have become more dynamic, and we are gradually moving from Industry 4.0 to Industry 5.0. But what is this new industrial revolution and what are its differences from the previous one?

This article analyzes the concepts of Industry 4.0 and 5.0, their key differences, technological innovations, and the impact on the human factor and the global economy.

Industry 4.0, or the fourth industrial revolution, is a concept that involves the integration of cyber-physical systems into production processes. The main components of Industry 4.0 are the Internet of Things (IoT), big data, artificial intelligence (AI), autonomous systems, robotics, and automation. Industry 4.0 aims to create smart factories where machines, systems and people work together to optimize productivity and reduce costs [1].

Key characteristics of Industry 4.0:

- increase the use of robots and automatic systems to perform routine tasks;
- creation of virtual copies of physical objects, which allows you to model and control their functioning;
- connecting devices and systems to a single network that allows you to transfer and analyze data in real time;
- big data analysis for decision-making in automated systems;

- combining all technologies to create production facilities that adapt to changes in demand, settings, and other factors.

Industry 5.0 is emerging as a response to challenges that cannot be solved by automation and robotics alone. It is more focused on human-machine collaboration and new social needs. According to this concept, technologies should work together with people, enhancing their abilities, rather than completely replacing them [2].

The main characteristics of Industry 5.0:

- the key emphasis is on people, where technology is used to improve working conditions, provide greater flexibility and creativity;
- the use of robots working alongside humans to improve the efficiency and quality of production.
- more attention to environmental and ethical aspects of production.
- Industry 5.0 technologies enable mass production of individualized products.
- the industry is focused on environmentally sustainable production with minimal negative impact on the environment.

The main differences between Industry 4.0 and Industry 5.0 [3]:

1. Automation versus human-centeredness;

Industry 4.0 focuses on maximizing the automation of production processes, where robots, control systems, and artificial intelligence play a major role. In this model, humans act as process supervisors, but their involvement is limited. In Industry 5.0, on the other hand, the focus is on human-machine collaboration. Robots and AI assist humans, but do not replace them completely.

2. Mass production versus personalization;

One of the goals of Industry 4.0 was to improve processes for the mass production of high quality goods. Industry 5.0, on the other hand, emphasizes the personalization of products to meet the individual needs of consumers. This is made possible by combining technology with human creativity.

3. Data protection and ethical issues [4];

Industry 4.0 actively uses big data to automate and optimize production processes, but this raises questions about data privacy and security. Industry 5.0 takes these issues to a new level by focusing on the ethical aspects of using technology, protecting privacy, and considering the social impact of new systems.

4. Environmental awareness;

While Industry 4.0 sought to improve production efficiency, environmental aspects were not a central theme of this revolution. Instead, Industry 5.0 puts sustainability and environmental issues at the forefront, emphasizing the use of energy-efficient and environmentally friendly technologies.

5. Creativity and innovation;

While Industry 4.0 focuses on automation and the use of algorithms to optimize processes, Industry 5.0 opens up new opportunities for human creativity. Robots and artificial intelligence are becoming tools that help people implement new ideas, create customized products, and innovate faster.

Let's take a closer look at the technologies that distinguish Industry 5.0 from 4.0.

Collaborative robots (Cobots). In Industry 5.0, robots do not just work autonomously, as was the case in Industry 4.0, but interact with people to help them complete tasks. Such robots are created to work together with people, which increases the efficiency of processes and allows combining machine power and human creativity [5].

Human-machine interfaces. In Industry 5.0, special attention is paid to the creation of simple and understandable user interfaces that allow for effective interaction with technology. These can be voice commands, gestures, or other natural forms of communication.

Neural networks and AI in decision-making. Artificial intelligence in Industry 5.0 not only analyzes data but also makes decisions based on neural networks that can learn and adapt to new conditions.

Biotechnology and nanotechnology. Compared to Industry 4.0, where the emphasis was on digital technologies, Industry 5.0 integrates new fields of science, such as biotechnology and nanotechnology, to create innovative materials and solutions.

The transition from Industry 4.0 to Industry 5.0 also has significant social implications. First, in Industry 4.0, fears arose that mass automation would lead to job losses as machines replaced human labor. Industry 5.0, however, seeks to change this perception by emphasizing human-machine collaboration, which creates new opportunities for workers [6].

In addition, Industry 5.0 raises the issue of social responsibility of business. This means that companies must not only optimize production but also take into account the impact of their actions on society and the environment.

To summarize, Industry 4.0 and Industry 5.0 are different stages of development of modern production, each with its own unique characteristics. Industry 4.0 focuses on automation, artificial intelligence, and robotics, while Industry 5.0 is more focused on human-machine cooperation, sustainable development, and social responsibility.

The main difference is that Industry 5.0 not only seeks to increase the efficiency of production, but also makes it more flexible, personalized, and environmentally sustainable. People are becoming the central figure in production processes, and technology is working to improve their capabilities and quality of life.

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