

## INDUSTRY 5.0 IN MODERN MANUFACTURING

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**Annotation:** The article examines the main aspects and prospects of Industry 5.0. This stage of production development emphasizes the interaction between people and machines, focusing on human-centricity and sustainable development. If Industry 4.0 focused on autonomous systems, then Industry 5.0 is aimed at the symbiosis of humans and robots, which allows combining the creative abilities of people with the precision and productivity of machines.

**Key words:** Industry 5.0, Industry 4.0, robotics, Human-centricity, Cobots.

Industry 4.0 involved integrating the Internet of Things (IoT), big data, and artificial intelligence to automate processes. However, Industry 5.0 shifts the focus to the collaboration of humans and machines. Robots do not replace workers, but help them solve problems with high accuracy, freeing up time for creative and intellectual aspects of work.

Let's consider the key aspects of industry 5.0:

1. Human-Centric – Industry 5.0 places people at the center of the production process, increasing their influence on the final product. Machines and robots act as assistants, increasing productivity and precision;

2. Collaborative robots (cobots) – Unlike traditional robots, cobots are safe to work near people. They perform tasks that require precision, strength or repeatability, while people focus on management and control;

3. Product customization – Industry 5.0 allows for the production of goods according to individual customer requests, while maintaining the scale of mass production. This is relevant for industries with a high level of product customization;

4. Sustainable development – Industry 5.0 technologies contribute to the environmentally friendly operation of enterprises. Attention to resources, waste reduction and the use of renewable energy are important components that help reduce the environmental footprint of production.

The main feature of Industry 5.0 is the focus on humans as the central element of the production process. In this paradigm, humans and machines work hand in hand, complementing each other. Robots do not replace humans, but help them perform complex tasks that require high levels of precision or repeatability. This allows humans to focus on more creative, innovative aspects of their work.

One of the key technology trends of Industry 5.0 is the introduction of collaborative robots, or cobots. These robots differ from traditional industrial robots in that they are specifically designed to safely interact with people in the same workspace. Cobots can perform tasks that require physical strength, endurance, or precision, freeing people up for more intellectual work.

Industry 5.0 also facilitates mass customization of products. Thanks to the flexibility and adaptability of robotic systems, businesses can produce goods that meet specific customer requirements on a mass production scale. This trend is directly related to the increasing demand for unique and personalized products.

Another important aspect of Industry 5.0 is the focus on environmental and social factors. Manufacturing companies strive to reduce their carbon footprint, minimize waste, and use resources more efficiently. Humans, as active participants in the production process, bring awareness and critical thinking, which helps to implement sustainable practices at all stages of production.

Consider the Benefits of Industry 5.0

- automated systems perform routine tasks, freeing people for creative work and decision-making;
- joint work of people and cobots allows to improve accuracy and reduce product defects;
- liberation from monotonous tasks and participation in creative processes increases motivation and involvement of workers;

– human-centricity of Industry 5.0 allows to optimize resource consumption and implement environmentally responsible practices.

But there are always aspects that create challenges. The introduction of new technologies requires training employees to interact with cobots and digital systems. Small and medium-sized enterprises may face difficulties in integrating robots and automated solutions due to high costs. There is a need to address employment issues and the ethical use of technology to ensure a safe and comfortable working environment.

The future of Industry 5.0 promises a deep integration of people and machines in production, opening up new opportunities for innovation. Robotics, artificial intelligence, and sustainability technologies will play a key role in solving global challenges such as climate change and resource depletion. Industry 5.0 makes production adaptive and environmentally responsible, and improves working conditions, encouraging a sustainable and conscious approach to production.

**CONCLUSIONS.** Industry 5.0 is the next stage of industrial evolution, which combines technological advances with human capabilities. The main difference between this concept and previous ones is its human-centricity, where humans and machines work closely together to achieve higher productivity and quality. Despite existing challenges, such as the need for personnel training and significant implementation costs, Industry 5.0 opens up new horizons for production, making it more adaptive, individualized and sustainable.

Industry 5.0 not only increases production efficiency, but also improves working conditions, enhances the role of humans in creative and intellectual processes and promotes sustainable development. This new stage in the industrial revolution promises to be key in building a more harmonious and balanced interaction between humans and technology, which will not only allow us to reach new heights in production, but also solve many global problems of our time..

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