

INCREASING EFFICIENCY THROUGH AUTOMATION AND DIGITAL TECHNOLOGIES

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Abstract: The rapid development of automation and digital technologies has become a key driver for increasing production efficiency in modern enterprises. Automation reduces the reliance on manual labor, minimizes errors, and ensures consistency in production processes, while digital technologies such as data analytics, IoT, and AI enable real-time monitoring, predictive maintenance, and optimization of resources. Integrating these technologies allows companies to streamline operations, reduce production costs, improve product quality, and enhance overall competitiveness. In addition, digital tools support better decision-making by providing actionable insights into production performance, resource utilization, and workflow efficiency. The implementation of automation and digital technologies is especially critical in highly competitive industries where speed, precision, and cost-effectiveness are essential for sustainable growth.

Keywords: Automation, Digital Technologies, Production Efficiency, Resource Optimization, Predictive Maintenance, Industrial Innovation

The use of information technology in production leads to the generalization of the quality of products and the simplification of labor. IT-system tools open up opportunities that are not possible in the conditions of the traditional industrial system. Computers perform routine tasks more accurately than people, because they rely on algorithms. Industrial automation and robotics is the use of computers, control systems and information technologies to control industrial processes and machines, replacing manual labor, increasing efficiency, speed, quality and productivity. Automation of production processes is the introduction of a system of tools that transfers production functions previously performed by humans to machines. Automation work is usually carried out in an integrated manner. At the same time, a complete restructuring of production operations is carried out through equipment upgrades, the introduction of industrial robots, software integration and other modernization processes. Increasing the profitability of an industrial enterprise is the main goal of automation. To do this, an automated system increases productivity and reduces production costs. This stage lasts quite a long time, and the result is not instant: the costs of automation are recouped on average in 1-3 years. Depending on the direction of activity and specific characteristics of the enterprise, the development of automation projects sets itself the appropriate tasks.

The main tasks of automation in increasing production efficiency

• Streamline production processes

	• Reduce personnel costs
	• Protect workers from injuries and hazardous substances
	• Reduce waste, improve product quality
	• Increase production volume, expand the range
	• Accelerate production work
	• Improve the company's reputation due to environmental friendliness of production
	• Increase productivity

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Automation of production is a multi-stage process and consists of many tasks. Regardless of its scale, the enterprise faces a number of features:

- Development, implementation and maintenance costs
- The need to attract highly qualified personnel
- Retraining of part of the workforce

Levels of application of mechanization and automation in production:

Step	Features
Zero automation	Mechanical or manual devices without software control are used. Operations are performed by full-time employees. Software is not implemented. The zero approach is possible under the following conditions: <ul style="list-style-type: none"> • Lack of financial resources necessary for the purchase of technological solutions • The specific characteristics of the enterprise make it impractical to introduce automation of the production process
Partial automation	Transferring routine operations to workshops - conveyors, sensors, alarms. <ul style="list-style-type: none"> • Automation of certain types of devices,

	<ul style="list-style-type: none"> • Most of the processes are performed by employees.
Complex automation	<p>The main processes are automated. However, human participation is also present, but in other aspects: control, troubleshooting, logistics, emergencies.</p> <ul style="list-style-type: none"> • All technological cycles are automated. • The equipment forms a single system. • The operator controls.
Complete	It is achieved gradually, initially the company goes through all the previous stages.

Regardless of the specifics of the enterprise, the development of software solutions unifies their common functionality. Technical changes cannot be implemented without a common database that unites and regulates the work of all departments. For this, computer integration has been created, which can automate management processes and help make effective decisions. The development of projects for automated systems with a wide range of functionality is individual for each organization. According to their common features, they can be combined into several groups. Full automation systems are available only to the largest manufacturers with large capital turnover. Modern technologies allow for a gradual transition to automated production processes. By making partial changes, medium and small enterprises can increase productivity at moderate costs.

Process automation is aimed at eliminating repetitive manual operations through the introduction of digital solutions and control systems. Robotization, in turn, involves the use of physical machines that can operate autonomously. Technological efficiency is usually expressed in an increase in product production as a result of automation, which is often associated with an increase in the quality of the manufactured product and a decrease in raw material costs. The introduction of robotization is especially effective in production segments that are characterized by high temperatures, high speeds or hazards to humans. For example, in the ceramic and porcelain industry, the use of robotic manipulators in processes such as moving tiles, loading and unloading them into high-temperature kilns ensures production safety and continuity. International experience shows that production costs in enterprises where robotization has been introduced have decreased by 12–18%, and the scrap rate has decreased by 20–30%. Advantages of using industrial robots: increased productivity; improved product quality; reduced labor costs; reduce the risk of accidents in production.

Automation undoubtedly has many advantages that can significantly improve the performance of a company. However, the success of such projects depends on many factors: the readiness of the corporate culture for change, support from management, a clear organization of the process and overcoming employee resistance. Avoiding common mistakes and careful planning will help a company get the most out of automation while reducing the risk of failure.

Advantages and disadvantages of automation

Benefits of automation	Disadvantages of automation
1. Increase efficiency. (Automation allows you to perform tasks faster and with fewer resources.)	1. High initial costs. The implementation of automated systems requires significant investments in software, equipment and employee training.
2. Reduce operating costs. (The use of automated systems can significantly reduce labor, material resources, and process	2. Employee resistance. Any innovation, including automation, can cause a negative reaction from employees, who may be afraid

management costs.)	of losing their jobs or changing traditional processes.
3. Improve the quality of products and services. (Automated processes provide high accuracy and consistent quality, which reduces the number of errors and improves the final product or service.)	3. Unpreparedness of corporate culture. The implementation of automation requires changes in business processes, and if the corporate culture is not ready for such changes
4. Transparency and control. Automation allows you to monitor all stages of the production process in real time.	4. Lack of support from management. If the project does not receive the necessary support at the management level, it risks failing.
5. Accelerate decision-making. Automation systems can provide management with real-time analytical data and reports, which helps to respond to changes faster and adapt to them.	5. The risk of excessive democracy. In automation projects, it is important that decisions are made quickly and unilaterally. If too many stakeholders with equal authority are involved in the process, the project may become deadlocked due to disagreements.

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