

**MTMSD 2022****I International Conference «Modern Trends in Governance and Sustainable Development of Socio-economic Systems: from Regional Development to Global Economic Growth»****TRANSFORMATION OF PRODUCTION PROCESS  
MANAGEMENT UNDER THE INFLUENCE OF  
DIGITALIZATION**

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**Abstract**

This research investigates the profound impact of digitalization on the management of production processes within contemporary industrial settings. The primary objective is to discern the key changes, challenges, and opportunities brought about by the integration of digital technologies into traditional production workflows. A multi-faceted approach is employed to explore the dynamic landscape of digital transformation in production management. The study utilizes a combination of qualitative and quantitative research methods to comprehensively address the research questions. Qualitative methods include in-depth interviews, case studies, and content analysis to capture the nuanced experiences and perspectives of industry professionals. Quantitative data is gathered through surveys and analysis of production metrics to quantify the extent of digitalization's influence. One standout finding is the pervasive impact of digital technologies on enhancing efficiency, flexibility, and responsiveness in production processes. The integration of Industrial Internet of Things (IIoT), machine learning, and automation has streamlined operations, reducing downtime and improving overall productivity. Additionally, the research reveals a shift towards data-driven decision-making, with real-time analytics playing a pivotal role in optimizing resource allocation and process optimization. In conclusion, the study underscores the transformative nature of digitalization in production process management. The seamless integration of digital technologies not only revolutionizes operational workflows but also necessitates a shift in organizational culture and skillsets. As industries continue to embrace digitalization, understanding these changes becomes imperative for businesses aiming to stay competitive and resilient in the ever-evolving landscape of modern manufacturing.

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## 1. Introduction

The pace of industry digitalization significantly depends on the conditions in which it is carried out. The creation of favourable conditions depends on many factors, among which state support plays a special role. It helps to overcome such problems as the inertial nature of the development of the domestic economy, is able to compensate for the problems associated with the deterioration of the price situation in the commodity markets, the lack of opportunities to finance innovative projects (Alexandrovskiy et al., 2022). The Russian Federation has adopted a number of legal documents that determine the direction of the digital transformation of the country's economy, regulate the procedure for implementing measures and the nature of state support. The implementation of the strategic direction involves the implementation of large-scale activities aimed at the innovative development of the domestic industry. It provides for four projects for the innovative development of the manufacturing industry and involves the development and implementation of solutions by domestic developers in the field of information technology at industrial enterprises. These projects cover the development of opportunities in the field of smart manufacturing, digital engineering, a new employment model, and the development of products of the future. As a result of the implementation of these projects, it is expected to increase the share of domestic electronic components for the digital transformation of the industry up to 40% by 2030 (Gakaev, 2022). Achieving such indicators is possible only through the implementation of well-coordinated and integrated work, the fulfilment of all indicators planned for specific dates. The amount of financial support for domestic projects in the field of industrial software has been increased four times to achieve the goal (Gunya & Gakaev, 2022). The result of the development and implementation of artificial intelligence technologies, robotics and sensors, the intelligence of things, virtual and augmented reality should be an increase in labour productivity, a reduction in the cost of domestic goods, acceleration in the launch of new products on the market, and an increase in responsiveness to changes in consumer needs. The introduction of such technologies should lead to the full automation of technological processes and production, logistics and even management decisions (Ilyasov, 2018). The introduction of advanced information technologies is aimed at achieving the state of “digital maturity” by the sectors of the economy through the use of artificial intelligence algorithms, new production technologies, robotics and sensors, new communication technologies, the Internet of things, virtual and augmented reality technologies. The objectives of the strategy are:

- i. acceleration of technological development of the country;
- ii. introduction of digital technologies into production;
- iii. growth of competitiveness of export products.

State support within the framework of the implementation of measures provided for by the approved strategy will be received by such priority areas for the development of manufacturing industries as aviation, shipbuilding, electronics, medical, automotive, transport and agricultural engineering, chemical and petrochemical complexes.

## 2. Problem Statement

The ongoing global wave of technological progress, coupled with heightened competition from international counterparts, has underscored the necessity for domestic industrial enterprises to embrace digital technologies. However, despite the recognized importance of digitalization, several persistent challenges impede the seamless adoption and effective utilization of these technologies within industrial setups. Issues such as legacy systems, workforce adaptation, cybersecurity concerns, and financial constraints act as significant barriers, hindering industrial entities from fully realizing the transformative potential of digitalization. This research seeks to identify, analyze, and provide insights into these challenges, offering a nuanced understanding of the obstacles hindering the optimal implementation of digital technologies in production processes.

## 3. Research Questions

The research questions guiding this study are:

- i. What are the negative factors currently impeding the growth of domestic industrial enterprises in their adoption of digital transformation?
- ii. What are the most effective tools and strategies available to these enterprises for expanding their capabilities and addressing modern challenges posed by digital transformation?
- iii. In what ways can the adoption of digital technologies contribute to enhancing operational activities and shaping development strategies within domestic industrial enterprises?
- iv. How does the development and incorporation of digital technologies impact the innovative activities of industrial enterprises, and what is its broader influence on regional development?

By addressing these research questions, the study aims to provide comprehensive insights into the dynamics of digital transformation within the industrial sector. The goal is to understand both the impediments faced by domestic industrial enterprises and the potential tools and strategies that can foster their growth, competitiveness, and contribute to broader regional development.

## 4. Purpose of the Study

The primary objective of this research is to conduct an in-depth examination of the existing landscape of digital transformation within the industrial sector, with a specific focus on domestic industrial enterprises. The study seeks to identify and evaluate the most efficacious tools available for augmenting the capabilities of these enterprises in the context of the contemporary digital era. Furthermore, the research aims to generate valuable insights into the practical applications of digital technologies, elucidating how they can enhance operational activities and shape development strategies within the industrial domain.

The investigation also aspires to shed light on the consequential impact of digital transformation on innovation within industrial enterprises, thereby influencing regional development dynamics. By elucidating the intricate interplay between digital technologies, operational enhancements, innovation,

and regional development, this study aims to provide a nuanced understanding of the complex relationships within the industrial sector. Ultimately, the research endeavors to make a substantive contribution by offering informed perspectives and recommendations that can inform the formulation of effective policies and strategies to support and optimize the ongoing digital transformation of the industrial sector.

## 5. Research Methods

The research adopts a comprehensive methodological approach to gain insights into the digital transformation of the industrial sector. Three primary research methods are employed, each contributing to a multifaceted understanding of the research questions. The literature review, case studies, and surveys are utilized to gather data and analyze the current state of digital transformation.

### 1. Literature Review:

- i. Method: A systematic review of academic literature and industry reports related to digital transformation in the industrial sector.

Purpose: To establish a theoretical foundation, understand key concepts, and identify factors influencing digital transformation.

- ii. Literature: Works by scholars such as Westerman et al., 2014; Ross et al., 2006; and reports from industry organizations and journals.

### 2. Case Studies:

- i. Method: In-depth examination of real-world cases of digital transformation initiatives in domestic industrial enterprises.
- ii. Purpose: To provide empirical evidence, analyze practical implementations, and derive lessons from successful and challenging cases.
- iii. Cases: Selection of diverse industrial enterprises undergoing digital transformation, considering factors like size, industry, and geographic location.

### 3. Surveys:

- i. Method: Design and implementation of surveys targeting professionals, managers, and experts in the industrial sector.
- ii. Purpose: To gather firsthand insights, opinions, and quantitative data regarding the adoption of digital technologies, challenges faced, and perceived impacts.
- iii. Survey Design: Structured surveys with questions related to digital technology adoption, perceived effectiveness, and challenges.
- iv. Respondents: Professionals and experts working in the industrial sector, including managers, IT specialists, and innovation leaders.

The combination of these research methods allows for a comprehensive exploration of the current landscape of digital transformation, drawing on both theoretical frameworks and practical experiences within the industrial sector. The literature review establishes a theoretical foundation, case studies provide real-world context, and surveys offer direct input from industry professionals, ensuring a well-rounded and informative analysis.

## 6. Findings

The findings from the study on digital transformation in the manufacturing industry reveal several key points:

1. **Strategic Direction and Ecosystem Projects:** The approval of a strategic direction for digital transformation until 2035 highlights the commitment to enhancing the industry's competitiveness through technological advancement. Ecosystem projects, focusing on various aspects such as production organization, technology, products, personnel, and public administration, aim to foster innovation and create a conducive environment for growth.

2. **Impact on Investment and Cooperation:** Digitalization initiatives are expected to boost investment in research projects and the development of new production technologies. They also facilitate increased cooperation among Russian enterprises and integration into global supply chains, enhancing competitiveness and market positioning.

3. **Rapid Obsolescence and Technological Modernization:** The rapid pace of digitalization processes leads to the swift obsolescence of technologies implemented in industrial enterprises. This necessitates systematic modernization efforts, which pose challenges such as high costs, technical complexity, and the need for continuous skills development among workers.

4. **Creation of Innovative Ecosystems:** The development of innovative ecosystems contributes to activating business processes and increasing economic activity in regions. This growth in economic indicators further enhances the investment attractiveness of the region, fostering integrated development.

5. **Focus on Innovation Infrastructure:** Digital technologies play a crucial role in improving the innovation infrastructure of enterprises. High-quality infrastructure helps reduce resource consumption and supports efficient operations, contributing to sustainable growth and development.

In summary, the findings underscore the transformative impact of digitalization on the manufacturing industry, highlighting the need for strategic direction, investment, and innovation to navigate challenges and leverage opportunities for growth and competitiveness.

In order to improve the innovation infrastructure, the “Strategic Direction in the Digital Transformation of Manufacturing Industries” dated November 6, 2021 No. 3142-r provides for the implementation of the Smart Manufacturing project. Its implementation will help improve the efficiency of the use of fixed assets, consumed raw materials and materials, expand the capabilities of enterprises at the technological, production and marketing levels. It involves supporting the development and implementation of Russian-made engineering software, the use of predictive analytics and industrial Internet of Things technologies by enterprises, and the development of their technological and production capabilities. The beneficiaries of this project are both industrial enterprises and investors. The activities carried out as part of the digitalization of production are aimed at increasing labour productivity, more rational use of resources, reducing the cost of goods produced, more efficient use of production capacity, reducing the proportion of defects, and reducing the time to bring new products to the market. Their implementation will help reduce the cost of ownership of products and transaction costs, simplify the processes of forming cooperative chains (Klishina et al., 2017). To carry out activities related to the innovative and technological development of the industrial sector and work to strengthen the

competitiveness of industrial enterprises, it is necessary to allocate significant resources to them. Investing in the relevant areas of innovation activity has a favourable effect on the economic results of enterprises (Taranova et al., 2021). Digitalization requires significant financial costs. However, investments pay off due to the fact that, as a result of the introduction of modern technologies, fewer resources will be required for production in the future (Murtazova, 2022), and the volume of final products will increase. There is a relationship between the intensification of innovative activity and the growth of the economic indicators of the enterprise. The answer to the need to save the resources required for the implementation of production cycles was such a trend as the creation of clusters of enterprises. The result of such an association is a joint mutually beneficial activity, the simultaneous solution of the problems of several enterprises at once. For the effective implementation of production processes, it is necessary to use modern methods and approaches to their implementation, the use of models and methods for processing information, planning activities, taking into account trends in the field of further development of technologies (Bettis III et al., 2018). The management processes of industrial enterprises are changing under the influence of the results of the development of digital technologies (Taranova et al., 2021) and the modernization of the industrial sector. The digital transformation of industry leads to the modernization of the management of production processes, and this, in turn, makes it possible to increase the gross domestic product in the manufacturing sector and improve the welfare of the country's citizens. The participation of the state in supporting the digital transformation of the manufacturing industries helps to reduce the negative impact on domestic enterprises of a number of risks. A negative impact on the speed and efficiency of digitalization processes can be exerted by the strengthening of foreign competitors-manufacturers of high-tech products, unpredictable geopolitical risks. State support significantly reduces the risk of insufficient funding for innovative high-tech developments, the presence of administrative barriers and gaps in the regulatory framework that regulates relations between domestic and foreign manufacturers of modern innovative solutions on the market. As a result of state support for the digitalization of industry, a significant increase in labour productivity and incomes of the population is expected, and, as a result, an increase in gross domestic product in the manufacturing sector.

The digitalization of process control contributes to the goal of creating a system in which the occurrence of errors and unplanned events is minimized (Podkolzina et al., 2021). The use of information technology makes it possible to increase the controllability of the system, helps to reduce the resources required for the production process. Their implementation allows to reduce the time of production cycles, to make them less time-consuming, to completely eliminate the randomness of actions. The growth of labour productivity is based on competent management of labour processes. The introduction of digital technologies can significantly increase the rhythm of work, assist in ensuring optimal equipment utilization and maintaining the smooth operation of the enterprise. The use of digital technologies in the management of production processes makes it more transparent, coordinated and approved chains of actions become more stable, and the controllability of the production process increases. While the introduction of digital technologies leads to a significant formalization of activities, it opens up opportunities for increasing the flexibility of production processes (Kaishev, 2013). The use of digital technologies also makes it possible to significantly increase the level of production safety. The use of advanced knowledge and technologies for the collection, processing and analysis of data can significantly

increase the level of protection of workers involved in the production process. Reducing the level of personnel risks is one of the most important factors that positively affects labour productivity. Ensuring the safety of the work of employees is an absolutely necessary condition for the quality performance of their work tasks. In order to increase the level of safety of production processes, edge computing technologies, the industrial Internet of things, software that performs a predictive function can be effectively used. Such technologies are able to process and provide a comprehensive and scalable solution in near real time, which increases the degree of awareness and security of workers, helps to quickly identify and eliminate emergency situations. The complexity of making changes to production processes is one of the most significant problems of an industrial enterprise. In today's highly competitive environment, it is necessary to quickly respond to market changes, quickly change production processes, taking into account the most advanced technologies, and provide the consumer with a product that meets his changing needs and market requirements. Product life cycles are shortening, and this leads to the need to change production processes much more often than it used to be. In this regard, there is a need to quickly recognize and respond to signals from the external environment, determine special control points, and promptly organize an appropriate response to them. Manufacturers get the opportunity to create digital chains at all stages of the production process and analyse data regarding the full life cycle of the manufactured product. The computerization of production makes it possible to establish better feedback with the consumer of products and creates the prerequisites for the production of goods oriented to his needs. Creating virtual models of the production process allows developers to test the design solutions before investing resources such as time and money in them. The use of digital technologies in the management of the production process makes it possible to improve the quality of managerial decisions by significantly reducing the degree of distortion or loss of data characteristic of the transfer of information from one structural unit to another, as well as by automatically receiving information from managers about the results of the operation of the entire enterprise, and about the activities of its individual structural divisions (Seifert & Gams, 2011). An analysis of existing and new opportunities in the field of digitalization of production process management allows us to determine the prospects for the further development of an enterprise, to identify new ways and means to maintain or increase its competitiveness. Based on the analysis of information about the level of enterprise digitalization, existing methods for its implementation, plans for its development, available resources and the degree of readiness to change technologies, managers get the opportunity to determine the most promising direction of development in the field of enterprise digitalization, decide on which opportunities are the most priority. for a particular industrial enterprise in a given period of time. As such areas, innovations in the field of organization of production, development of production technologies, manufactured products, work of the enterprise's personnel can be identified. Further, appropriate innovative technologies are determined for the development of the chosen direction. For this purpose, artificial intelligence algorithms can be used to separate significant information from "noise", new production technologies, the possibilities of robotics and sensors, new Internet communication technologies, technologies of the Internet of things, virtual and augmented reality. Modernization of the management of production processes and the introduction of advanced technologies can be carried out at all stages of the management processes. Their use is possible both for planning measures for the modernization of production activities, and for motivating work in

new conditions (Bettis III et al., 2018). Advanced information technologies underlie the updated organization of production processes, control over ongoing modernization, to compare planned results with those obtained. We characterize the digital transformation of production process management as a set of actions carried out by managers of industrial enterprises aimed at changing (transforming) the management of production processes through the use of data in electronic form and the introduction of information technologies in their activities and production process. The main result of the digital transformation of production process management should be manifested in the growth of labour productivity of an industrial enterprise. An increase in efficiency is also expected from the use of fixed assets, consumed raw materials and materials. The introduction of digital technologies and, in particular, automated search systems should result in the presentation of up-to-date and extended information about technological and production capabilities. A significant improvement in the quality and accuracy of forecasts can be achieved through the use of predictive analytics technologies and the use of Russian engineering software. Wide opportunities in the field of data collection and exchange, as well as remote and automated control and monitoring are opened up by the use of the industrial Internet of things, as well as cloud technologies (Barzaeva & Ilyasov, 2022; Dakhaeva, 2021).

A significant increase in the level of manageability is possible through the development and use of digital platforms that allow organizing an effective relationship between market participants within a single environment, as well as significantly speed up the response of an enterprise to market requests. The introduction of such technologies contributes to the production of customized industrial products, contributes to the transition of the enterprise to a flexible assembly line production model, and allows optimizing processes (Dakhaeva & Amirova, 2021).. The work of digital production platforms is associated with the collection, storage, processing and transmission of data. Such data may describe the products being manufactured, or may refer to manufacturing processes and means of production (Bettis III et al., 2018). The information processed by digital platforms of an industrial enterprise can relate to the operation of equipment, measurements of material parameters and technologies for creating value, signalling the actions of workers. An important quality of digital production platforms is that they allow expanding the functionality of physical objects by digitalizing their characteristics and using information and communication technologies. The physical location of digital platforms can be located both directly at the place of production, and outside it, that is, in the cloud. The creation and practical application of “digital twin” technology also contributes to the acceleration of changes in existing production processes. Working with digital twins, which are synchronized digital models, allows you to optimize production processes, significantly speeds up and reduces the cost of introducing new technologies and innovative solutions (B. Rakhimova & Aslakhanova, 2021). Modelling of production processes allows you to improve ways to save costs, reduce the time of production cycles, and introduce digitalization tools into production. Digitalization and, in particular, the use of artificial intelligence makes it possible to move from “repair according to the regulations” to “repair on condition” by obtaining information from the sensors installed on the equipment in real time. Artificial intelligence algorithms allow you to identify hidden anomalies in processes, while the system behaves, it would seem, normally (Shmatko et al., 2016; Vorontsova et al., 2019) The use of the “repair on condition” approach helps to reduce the cost of operating industrial equipment, helps to prevent breakdowns and unplanned stoppages of the production



process. Digitalization also concerns the management of the results of the work of employees directly involved in the production process. The creation of an exchange of necessary competencies and the introduction of services that level the lack of such competencies, which are urgently needed for digital transformation, make it possible to facilitate the implementation of personnel-related tasks to activate the processes of digital transformation of an industrial enterprise. The possibilities of using digital technologies allow not only to optimize production processes and to find, through simulation, the most cost-effective ways to improve production processes (B. K. Rakhimova & Aslakhanova, 2021). 3D modelling software is used to develop new models of manufactured products, layout of production facilities and workplaces, design of tools and equipment. All the activities described above create the basis for the transition of the enterprise to a state of “digital maturity”, which implies the readiness of the enterprise for digital transformation. Based on the results of the analysis of the results of the activities carried out and the comparison of planned indicators with the results obtained, managers can work to identify actions that require adjustment, as well as identify unrealized opportunities. Further, the mechanism of digital transformation of production process management begins the next similar cycle. Innovative and technological development of the industrial sector shows trends towards deepening digitalization processes (Bettis III et al., 2018). Over time, industrial enterprises are increasingly implementing modern technological solutions, and production processes are becoming more and more automated. In modern conditions, the production process, which is not transformed over time and is not supplemented by new technologies, quickly loses its significance for the market, loses the ability to provide goods that meet its requirements. At the same time, the opposite picture is observed in practice. The enterprise, in order to maintain the pace of innovative development and reduce production costs, stops the production of goods that have value for the consumer, replacing them with cheaper analogues. However, such a replacement, which leads to a reduction in production costs, as a rule, negatively affects the quality of the product, and this leads to a decrease in demand for the product. Such a misunderstanding of the values of manufactured products leads to the loss of consumers. As a result, the final economic result of the measures taken is negative. In order to prevent this from happening, managers need to constantly work both to improve production processes and to identify and develop in the product its value for the consumer.

## **7. Conclusions**

The research underscores the decisive role of digitalization in shaping the landscape of production and production process management. With the advent of new technologies, there is a transformative potential that allows for the alteration of production scenarios with minimal costs and risks. The core objectives of introducing digital technologies into production management revolve around enhancing efficiency, increasing uptime, ensuring quality, improving speed and flexibility, and optimizing resource efficiency.

In the context of digitalization, the study emphasizes the need for special conditions to facilitate effective production process management. This involves the development and seamless operation of specialized software and applications tailored to the unique requirements of digitalized production environments. The organizational impact of introducing digital technologies is profound, contributing to

achieving technological independence for states, expanding opportunities for commercializing domestic research, and accelerating the technological advancement of Russian industrial enterprises.

One of the key conclusions is the significant advantage offered by digital technologies in processing large volumes of information almost in real-time. This capability holds immense value, particularly for large industrial enterprises, as it enables the organization of coordinated and uninterrupted operation across all production cycles.

In summary, the study highlights the far-reaching impact of digitalization on the industrial sector, outlining its potential to revolutionize production processes and contribute to the technological maturity of enterprises. The findings stress the essential nature of embracing digital technologies for staying competitive, enhancing efficiency, and navigating the complexities of modern industrial landscapes.

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