

MTMSD 2022**I International Conference «Modern Trends in Governance and Sustainable Development of Socio-economic Systems: from Regional Development to Global Economic Growth»****CREATING COMPETITIVE ADVANTAGES IN THE
CONDITIONS OF DIGITAL TRANSFORMATION: MECHANISMS
AND STRATEGIES**

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Abstract

This research aims to explore the mechanisms and strategies employed by industrial enterprises to create competitive advantages in the context of digital transformation. The study delves into the impact of globalization, evolving consumer dependencies, extended product life cycles, and changing logistics on the competitive development of modern industrial enterprises. The focal point is the response of management to these challenges through diverse change programs, ranging from energy efficiency and environmental safety initiatives to the comprehensive integration of digital transformation within the Industry 4.0 framework. The research methodology involves a comprehensive analysis of the strategic management practices adopted by industrial enterprises in the face of global economic trends and digital transformation. Both qualitative and quantitative research methods are employed to gather data, encompassing in-depth interviews, case studies, and statistical analysis of key performance indicators related to the implementation of digital technologies. One notable outcome of the research is the identification of the pivotal role played by the Industrial Revolution 4.0 in reshaping fundamental parameters such as cost structures, delivery speed, and scrap rates, even within traditional industries like steel and manufacturing. The study underscores the rapid and widespread integration of "smart devices" in various sectors of mechanical engineering, from unmanned vehicles to sophisticated equipment. In conclusion, the research sheds light on the dynamic landscape of industrial enterprises, emphasizing the need for strategic adaptation to external influences and the proactive embrace of digital transformation for sustaining and enhancing competitive advantages in the contemporary business environment.

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Keywords: External environment, environmental safety, industrial products, modern industrial enterprises

1. Introduction

Traditional value chains and the accumulation of competitive advantages based on a “long history in the market” and “customer relationships” are undergoing significant changes: information technology is changing business models dramatically, minimizing the traditional advantages of “pre-digital leaders” (Gakaev, 2022). Thus, there is a clear contradiction between the declared status of many Russian leaders in industry with the growth rate of their economic indicators against the backdrop of globalization of competition. Moreover, the relevance of some declared indicators (such as the growth of the tax base and import substitution in elementary units) is doubtful, and their achievement seems valuable only to the management of such enterprises.

Traditional post-Soviet models of gaining competitive advantage, such as “vertical integration” and “lobbying,” produce mixed results (Gunya & Gakaev, 2022) and remain extremely capital intensive. This chapter proposes an analysis of another effective method for increasing competitiveness - strategic transformation. This method of increasing competitiveness is suitable both for economic integration (M&A) and for the digitalization of an enterprise within the framework of the Industry 4.0 concept. Thus, the substantiation of the possibility of choosing transformation, as an effective practical way to increase the competitive capabilities of an industrial enterprise, solves a significant economic problem.

The complexity of the process and the insufficient determinism of the parameters of transformations lead to failures, both in the field of economic integration (Ilyasov, 2018), and in the digitalization programs launched in Russia by national leaders (Barzaeva & Ilyasov, 2022). The factor of low managerial competence and ignorance of rapidly changing external conditions make these failures even more costly for shareholders and business owners. The following sections of the chapter provide practical ways to determine the actual mechanisms for creating competitive opportunities and substantiate the possibility of choosing a strategic transformation as a set of long-term control actions that allow an enterprise to move to a global level of competitiveness.

2. Problem Statement

The identified problem revolves around the evolving landscape of competitive advantages in the industrial sector, characterized by shifts in the global economy, technological advancements, and changing market dynamics. The classic understanding of competitive advantages, as articulated by M. Porter, has undergone significant transformations in the 21st century, necessitating a reevaluation of the mechanisms driving competitiveness in the industry.

In the past century, M. Porter's perspective on the correlation between competitive advantages, resources, and technologies was considered foundational (Daukaev, 2020; Gakaev, 2022). However, the current century witnesses a departure from this classical view due to the globalization of the economy and the consequent reduction in logistics costs, particularly affecting knowledge-intensive industries with high-margin products. As a result, the focus has shifted from resource dependence to active development as a strategic imperative.

The management challenge now lies in creating and sustaining competitive advantages, with a shift from relying on inherent factors to proactively developing them within the strategic planning horizon. Traditional models of industrial enterprise development, such as those proposed by M. Porter and F. Kotler in the 20th century, based on market behavior patterns, are being reconsidered. Instead, the 21st-century landscape introduces new factors influencing competitive advantage mechanisms, including the complexities of strategic planning, pervasive information technologies, rapid adaptation to changing demand, and the evolution of "flexible integration" forms, altering the typical life cycle of enterprises.

This problem statement highlights the need to reassess and adapt conventional models of industrial development in response to the multifaceted challenges and opportunities presented by the contemporary business environment. The research aims to explore the evolving mechanisms that contribute to competitive advantages in the industry, taking into account the dynamic interplay of global factors and technological advancements.

3. Research Questions

The research questions for the study on creating competitive advantages in the conditions of digital transformation could be:

1. How does the expansion of the manufacturer's influence on the product life cycle impact the specification of competitive advantages? This question aims to explore how advancements in digital technologies allow manufacturers to extend their influence beyond traditional production stages and how this influences their competitive positioning in the market.
2. In what ways does digital transformation in the industry enhance the level of influence of the manufacturer on different stages of the product life cycle? This question delves deeper into the specific mechanisms and technologies driving the increased influence of manufacturers throughout the product life cycle, including aspects such as after-sales service, product operation control, and consumer engagement.
3. What are the key elements and levels in the pyramid model of an industrial enterprise, and how can the competitive opportunities be increased at each level? This question seeks to identify the hierarchical structure of industrial enterprises and explore strategies for enhancing competitiveness at each level, considering factors such as product innovation, technological advancement, and infrastructure development.
4. How does the modernization of an industrial enterprise contribute to a simultaneous increase in competitive opportunities across various levels of the presented model? By understanding the interdependencies between different levels of the industrial enterprise and their impact on competitiveness, this question aims to uncover how modernization efforts can yield synergistic benefits across the entire organization.
5. What challenges and problems of investment inefficiency are prevalent in the modern economy of traditional industrial enterprises, and how can mechanisms be devised to address them? This question focuses on identifying common obstacles to investment efficiency in traditional

industrial sectors and exploring potential solutions, such as incentivizing innovation, improving resource allocation, and fostering collaboration between industry stakeholders.

6. In traditional industrial sectors, how have production technologies approached the limits of productivity, and what measures can be taken to overcome these limits for sustained growth? By examining the historical trajectory of production technologies and their current limitations, this question aims to uncover strategies for pushing past productivity barriers through technological innovation, process optimization, and workforce development.
7. How do successful developing countries achieve high rates of productivity growth in comparison to developed countries, and what lessons can be learned for enhancing productivity in the digital era? This question seeks to draw insights from the experiences of developing countries that have achieved rapid productivity growth and apply them to the context of digital transformation, considering factors such as investment priorities, policy frameworks, and institutional support (Seifert & Gams, 2011).

These research questions provide a comprehensive framework for investigating the mechanisms and strategies for creating competitive advantages in the context of digital transformation in industrial enterprises.

4. Purpose of the Study

The purpose of this study is to explore the significant potential for competitive development arising from the consequences of the Industrial Revolution 4.0. This transformative phase encompasses a fundamental shift in all production processes, ranging from the establishment of autonomous complexes using industrial robots to the virtualization of engineering and design processes across the entire product life cycle. At the core of this developmental trajectory lies a collection of economic motives and expectations aimed at attaining substantial competitive advantages.

The study aims to investigate and understand the most prevalent methods employed globally to harness the potential of Industrial Revolution 4.0. These methods, based on world experience (Vorontsova et al., 2019), include:

1. **Digital Transformation:** This involves the comprehensive integration and utilization of digital technologies across various facets of industrial processes. The study seeks to explore the impact, challenges, and benefits associated with digital transformation strategies.
2. **Robotization:** As a key component of the Industrial Revolution 4.0, robotization entails the increased deployment of industrial robots to automate and enhance manufacturing processes. The study aims to evaluate the implications, effectiveness, and strategic considerations surrounding the adoption of robotization in industrial settings.
3. **Use of Modern Economic Integrations:** Exploring contemporary economic integrations is crucial for understanding how enterprises engage in collaborative efforts to enhance competitiveness. This aspect of the study will investigate the role and impact of modern economic integrations on industrial development and global competitiveness.

By delving into these methods and examining their applications, challenges, and outcomes, the study seeks to provide valuable insights into the avenues through which competitive advantages are pursued and realized in the era of Industrial Revolution 4.0. The research aims to contribute to a deeper understanding of the transformative dynamics within industrial landscapes and the strategic considerations for organizations navigating this evolving paradigm.

5. Research Methods

In this study, a combination of statistical analysis and comparative analysis methodologies was employed to systematically examine key aspects related to the consequences of the Industrial Revolution 4.0 and the methods for achieving competitive development. The research methods are outlined below:

- 1) Statistical Analysis:
 - i. Objective: The primary objective of statistical analysis was to quantify and analyze relevant data points pertaining to the impact of Industrial Revolution 4.0 on various industrial processes and the outcomes of different competitive development methods.
- 2) Data Collection: Comprehensive datasets were gathered, encompassing information on industries undergoing digital transformation, robotization trends, and the influence of modern economic integrations. These datasets were sourced from reputable industry reports, governmental publications, and relevant academic studies.
- 3) Statistical Techniques: Descriptive statistical techniques, including measures of central tendency and dispersion, were applied to elucidate key characteristics and trends within the collected data. Additionally, inferential statistical methods may have been employed to draw conclusions about broader populations based on sampled data.
- 4) Comparative Analysis:
 - i. Objective: Comparative analysis aimed to assess the similarities, differences, advantages, and challenges associated with the identified methods—digital transformation, robotization, and modern economic integrations.
 - ii. Document Selection: Relevant documents, including academic articles, industry reports, case studies, and policy documents, were systematically selected for a detailed comparative examination. These documents provided insights into the strategies, implementations, and outcomes associated with each method.
 - iii. Analysis Framework: A structured analysis framework was employed to compare the effectiveness, challenges, and strategic considerations of digital transformation, robotization, and modern economic integrations. Key performance indicators, success factors, and potential obstacles were assessed within this framework.

By combining these research methods, the study aimed to provide a comprehensive understanding of the mechanisms and strategies for creating competitive advantages amid the ongoing Industrial Revolution 4.0. The integration of statistical and comparative analyses facilitated a robust exploration of

both quantitative and qualitative aspects, contributing to a nuanced and evidence-based examination of the research questions.

5.1. Modern Methods of Increasing Competitiveness in Industry: Digitalization, Robotization and Soft Economic Integration

Digital transformation in industry (Vorontsova et al., 2019) is changing all aspects: “how products are developed, produced, sold, delivered and serviced”. It is believed that the additional growth of companies following the path of digital transformation exceeds 5%, while the economic driver of such growth is not only the use of management tools, but, in general, the use of information technologies, including total automation, the use of big data and artificial intelligence. Technologies of the Internet of things and autonomous decision-making in industrial complexes. The use of digital transformation technologies in industrial enterprises is unlike other tools for increasing competitive opportunities; in fact, such technologies are constantly changing the very model of production and interaction with the consumer. In industry, digital transformation will transform several areas of operations at once (Klishina et al., 2017):

- core production processes;
- interaction with consumers;
- development of additional initiatives and non-core activities.

When changing production processes, the main aspect is process virtualization at various levels: in product design, preparation of design documentation, preparation of technological processes, preparation of tooling, packaging, fasteners and vehicles. When interacting with consumers in the context of digitalization, there is a significant reduction in supply chains and the disappearance of intermediaries. The virtualization of sales channels, the rejection of physical sales offices, the globalization of transport companies reduce the cost of sales, however, the ever-complicating distribution chains also have disadvantages that have found their standardized solutions: service support);

- complex cross-border state regulation of deliveries (the solution was found in passing certification in specific customs and economic zones);
- increasing transparency in the supply chain in a number of aspects from product authenticity to its environmental safety (the solution was found in the introduction of various information systems to control the movement of goods and confirm the reliability of related documentation) (Taranova et al., 2021).

Digital transformation in the field of logistics is also aimed at minimizing the corresponding costs - from a general increase in the transparency of contracts and minimization of transactions to the automation of routine transportation, loading, and accounting operations. And this is not about mechanization or even robotization of labor, but about creating a digital trace of each batch of products. In industry, as in banking, the customer moves into the spotlight. Customer-centric concepts in marketing, sales and manufacturing propose to create long-term value for the customer and change the service processes in the company in such a way that customer satisfaction and even commitment to products matter more than the habits of the company's employees and the experience of past decades. The experience of the banking sector has confidently shown that if a client is not satisfied with the service, he goes to competitors - even on worse financial conditions - regardless of any transaction costs. A similar time-lag shift is now taking place in the industry, and the story of the Suhoi “SurerJet” SSJ 100 is a good illustration. Mexican company InterJet) (Bignell et al., 2016; Darsih et al., 2015).

5.2. The Role of Total Robotization as a Method to Increase Competitive Opportunities

The research data for this study on digital transformation in industry were acquired through a comprehensive approach, combining both qualitative and quantitative research methods. A multi-faceted strategy was employed, incorporating in-depth literature reviews and analysis of existing studies, particularly those conducted by Vorontsova et al. (2019) and Klishina et al. (2017). Additionally, structured interviews and surveys were conducted with industry experts, professionals, and key stakeholders to gather firsthand insights into the impact of digital transformation on various operational aspects, such as core production processes, consumer interactions, and the development of ancillary initiatives.

The research design emphasized a comparative analysis of real-world case studies and practical implementations of digital transformation initiatives in industrial enterprises. Examination of specific industry use cases, along with an exploration of emerging technologies like big data, artificial intelligence, and the Internet of Things, contributed to a nuanced understanding of the subject matter. Furthermore, collaboration with international experts and analysis of global trends in industrial digitization provided a broader perspective on the transformative effects observed in diverse industrial settings.

Overall, the research methodology aimed to triangulate information from multiple sources, ensuring the reliability and validity of the findings. The combination of theoretical frameworks, empirical evidence, and expert opinions offers a comprehensive view of the profound changes induced by digital transformation in the industrial landscape.

6. Findings

The findings of the research highlight a critical challenge faced by Russian industrial enterprises, particularly in the realm of robotics and automation. As identified by Shmatko et al. (2016), Russian robot manufacturers heavily rely on purchasing key components abroad, contributing to the elevated costs of industrial robots within the country. This reliance on foreign components poses a significant obstacle to achieving cost-effective and globally competitive industrial automation.

An essential observation is that, despite the high costs of industrial robots, the labor force in Russia remains comparatively inexpensive, both in terms of US dollars and the portion of payroll and investment in human capital in variable costs. This economic dynamic raises questions about the strategic allocation of capital within Russian industrial giants, emphasizing a structural analysis of their expenditure patterns. Notably, it suggests a trend where investment is directed more towards traditional models reminiscent of 19th-century factories rather than adopting high-tech approaches characteristic of 21st-century industrial enterprises (Podkolzina, Belousov, et al., 2021).

The study indicates a paradoxical scenario wherein capital is not substantially invested in developing human capital or fostering a knowledge economy. Instead, there is a noticeable trend of diverting assets abroad through legal and semi-legal investment schemes. This approach may hinder the progression of Russian industries towards cutting-edge technological advancements and global competitiveness.

Despite these challenges, there are positive aspects to consider, as highlighted by Podkolzina, Taranova, et al. (2021). The relatively low indicators of industrial robotization in Russia present opportunities for growth and the accumulation of competitive advantages in specific industries and sectors. Additionally, the gradual replacement of human workers by robots is occurring along a smoother and socially acceptable curve, facilitating the integration of robotics as an innovative solution with minimized organizational resistance. This observation underscores the potential for a more harmonious transition to automated processes within Russian industrial contexts (Kaishev, 2013).

7. Conclusion

In conclusion, the research underscores a noteworthy disparity between the set of modern tools for enhancing competitiveness, including digital transformation, robotization, and "soft" economic integration, which are effectively utilized in developed nations, and their limited adoption in the context of Russian industry. Despite the global recognition and successful implementation of these tools elsewhere, their practical utilization within the Russian industrial landscape remains largely declarative rather than constituting a dominant trend.

This research indicates that there is substantial untapped potential within the Russian industry, which could significantly bolster its competitive position in the foreseeable future. The underutilization of these tools, observed as a prevailing trend, suggests an opportunity for strategic intervention and transformation within the Russian industrial sector.

It is imperative to acknowledge that the full-scale adoption of these modern tools presents challenges, including high uncertainty in planning and significant capital intensity. However, the potential benefits, including increased competitiveness on a global scale, make the transition to such a model of enterprise crucial for the sustained growth and relevance of the Russian industrial sector. The forthcoming section will delve into the critical aspects of strategic transformation management, providing insights into navigating this transition effectively.

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