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ИСКУССТВЕННЫЙ ИНТЕЛЛЕКТ И БОЛЬШИЕ ДАННЫЕ В ТРАНСФОРМАЦИИ МОДЕЛЕЙ УПРАВЛЕНИЯ ДЛЯ ИНТЕГРАЦИИ ЦИФРОВОЙ ЭКОНОМИКИ И ТРАДИЦИОННОЙ ИНДУСТРИИ

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Аннотация. Бурное развитие технологий искусственного интеллекта (ИИ) и больших данных стало решающим фактором трансформации моделей управления в различных отраслях. Их интеграция в традиционную индустрию позволяет цифровой экономике ускорять инновации, оптимизировать процессы принятия решений и повышать эффективность на разных уровнях организации. В данной статье рассматривается роль ИИ и больших данных в переосмыслении моделей управления, с акцентом на то, как цифровые инструменты повышают конкурентоспособность промышленности, поддерживают устойчивое развитие и способствуют сближению цифровой и традиционной экономических структур. Особое внимание уделяется практическим приложениям, потенциальным вызовам и стратегиям баланса между технологическими инновациями и организационной адаптацией.

Ключевые слова: искусственный интеллект, большие данные, цифровая экономика, модели управления, индустриальная трансформация, инновации, устойчивое развитие.

Introduction

The global economy is experiencing profound changes under the influence of digital technologies, artificial intelligence, and big data. These technologies are not only reshaping the structure of industries but also transforming traditional management models. The digital economy, characterized by data-driven decision-making, automation, and intelligent systems, requires companies to adapt to new methods of governance and innovation in order to remain competitive in an increasingly complex environment.

Traditional industries, such as manufacturing, finance, energy, and services, are facing both challenges and opportunities as they integrate digital tools into their operational frameworks. On the one hand, AI and big data provide unprecedented capabilities for predictive analytics, process optimization, and customer relationship management. For example, AI-powered big data analytics has been shown to enhance decision-making in finance, supply chains, and smart manufacturing by improving efficiency and adaptability [0].

On the other hand, organizations must overcome barriers such as data security risks, skill shortages, and cultural resistance to technological change [1].

The transformation of management models is at the core of this integration process. Unlike classical management approaches that rely heavily on hierarchical structures and intuition-based decisions, AI-driven and data-driven models emphasize flexibility, real-time analysis, and predictive capabilities. This paradigm shift is redefining the role of managers, enabling them to make informed decisions supported by large-scale data analysis and advanced algorithms.

This paper aims to explore the role of artificial intelligence and big data in the transformation of management models for the integration of the digital economy and traditional industry. The study focuses on theoretical foundations, practical cases, challenges, and strategic recommendations for organizations and policymakers. By analyzing global trends as well as experiences from China and Serbia, the research seeks to provide insights into how businesses can effectively leverage AI and big data to achieve sustainable development and competitive advantage [2.

Theoretical Foundations of Digital Economy and Management

The emergence of the digital economy is closely linked with the development of big data, artificial intelligence, and advanced information and communication technologies. In contrast to traditional economic models that primarily depend on labor and physical capital, the digital economy emphasizes data as a central production factor. Within this framework, data are considered a critical resource for innovation, value creation, and the restructuring of management practices. Researchers note that data-driven governance provides new opportunities for decision-making and transparency in economic systems, but also raises questions of regulation and control in the context of «data capitalism» [3].

Theoretical approaches to the digital economy often highlight its departure from hierarchical and intuition-based management systems. Instead, management becomes more adaptive and analytical, with AI and big data enabling predictive models of decision-making. Studies show that digital technologies expand the scope of economic forecasting and allow managers to integrate economic, political, and social factors into their decision processes more effectively than traditional statistical methods [4].

A key element of these foundations is the role of organizational knowledge management in digital transformation. Knowledge that was once mainly human-centered is now increasingly stored and processed through AI-supported systems. Big data infrastructures collect, structure, and analyze information, providing managers with insights that were previously unavailable. This integration of AI and knowledge management lays the groundwork for new management models that rely on continuous learning and real-time decision support [5].

AI and Big Data as Drivers of Transformation

Artificial Intelligence and Big Data are among the most significant technological forces driving the transformation of management models in the era of the digital economy and Industry 4.0. Their combined role lies in enabling predictive, adaptive, and data-driven decision-making processes that improve efficiency, reduce costs, and create sustainable competitive advantages for organizations.

In industrial contexts, the integration of AI and Big Data has fundamentally changed production systems. Studies on pharmaceutical manufacturing highlight that AI enhances drug discovery and quality control through predictive modeling, while Big Data ensures compliance and enables personalized production. Together with the Internet of Things (IoT), these technologies facilitate smart manufacturing, real-time monitoring, and predictive maintenance, which represent core components of Industry 4.0 [6].

Beyond manufacturing, the broader implications of AI-assisted Big Data Analytics (BDA) extend to sustainable strategic development. Research in the Italian manufacturing sector shows that AI-driven BDA improves resource efficiency, reduces waste, and aligns with circular economy principles. This demonstrates how digital technologies not only increase operational performance but also support environmental and social governance objectives [7].

From a managerial perspective, Big Data has become a critical tool for improving operational efficiency and decision-making. Analyses of Industry 4.0 applications show that real-time monitoring, predictive analytics, and optimization of production processes reduce downtime and enhance resource allocation. However, challenges such as data privacy, cybersecurity, and the need for advanced analytical skills remain obstacles to full-scale adoption [8].

The role of AI and Big Data in transformation extends beyond operational gains. They reshape organizational strategies by enabling predictive maintenance, automating decision processes, and supporting innovation in products and services. Their influence fosters a paradigm where management models are less hierarchical and more adaptive, built around continuous learning and rapid data-driven responses to dynamic environments.

New Management Models in the Context of Digital Transformation

The integration of artificial intelligence and big data into organizations has led to the emergence of new management models that go beyond traditional hierarchical approaches. Digital transformation requires flexibility, adaptability, and responsiveness, which are increasingly enabled by data-driven tools and AI-based decision-making systems. These changes are reshaping organizational strategies, business processes, and leadership practices.

One key dimension of these new models is the emphasis on agile and adaptive leadership. Managers must respond quickly to changes in the business environment by relying on real-time data analysis and predictive insights. Studies show that effective digital transformation depends not only

on technology adoption but also on change management strategies that address employee resistance, data security risks, and infrastructure readiness. Organizations with visionary leadership and well-developed training programs are more likely to succeed in this transition [9].

Another important element is the design of innovative managerial models that integrate digital platforms and collaborative structures. Research has proposed new frameworks for digital management that rely on employee participation, data transparency, and strategic flexibility. These models highlight the need for organizations to foster a digital culture that reduces resistance to change and encourages innovation [10].

Additionally, digital transformation drives innovation in business management by reshaping organizational structures, human resource practices, and performance evaluation systems. Enterprises are urged to break through traditional limitations and adopt intelligent management processes based on AI and big data analytics. These changes include optimizing workflows, cultivating digital competencies, and embedding continuous learning into organizational practices [12].

The new management models emerging from digital transformation thus combine adaptive leadership, data-driven governance, and organizational innovation. They represent a shift from rigid, hierarchical systems to dynamic and flexible structures that can meet the demands of the digital economy.

Integration of Digital Economy and Traditional Industry

The integration of the digital economy with traditional industries represents one of the most critical aspects of contemporary economic transformation. Digital technologies such as artificial intelligence, big data, blockchain, and the Internet of Things (IoT) are enabling the modernization of established industries including manufacturing, finance, logistics, and energy. This integration supports higher efficiency, innovation, and sustainability, while also creating new business models and value chains.

In manufacturing, the digital economy accelerates the transition toward intelligent production systems, also referred to as Industry 4.0. Research on the Chinese manufacturing sector shows that the digital economy drives the high-quality development of traditional industries by introducing data-driven processes, smart supply chain management, and predictive maintenance tools [12].

Similarly, the automotive industry illustrates how AI-embedded systems and big data analytics can enhance product development and improve competitiveness, though integration challenges remain significant [13].

The financial sector also benefits from the application of digital economy tools. Studies highlight that the adoption of cloud computing, big data, blockchain, and AI technologies increases competitiveness, enables more efficient risk management, and improves customer service in banking and insurance industries. However, implementation faces obstacles such as high transition costs and the lack of unified regulatory frameworks [14].

Another important dimension of integration is the improvement of energy productivity and sustainability. Empirical research demonstrates that digital-real economy integration, supported by AI and embodied technological progress, enhances resource allocation and energy efficiency in enterprises. This is particularly relevant for industries that are both resource-intensive and environmentally challenging [15].

Overall, the integration of the digital economy with traditional industries is not limited to technological innovation; it also reshapes organizational strategies, business models, and regulatory practices. Its impact extends across multiple domains, enabling industries to remain competitive while adapting to the demands of sustainability and globalization.

Practical Cases and Examples

The practical application of artificial intelligence (AI) and big data in traditional industries shows how digital transformation is progressing worldwide. The following table summarizes representative cases:

Region / Country	Industry	Application of AI & Big Data	Impact / Outcome
Germany	Manufacturing (Industry 4.0)	Predictive maintenance, IoT-enabled production, real-time analytics	Reduced downtime, optimized resource allocation, enhanced global competitiveness
China	Smart Manufacturing	AI-driven quality inspection, big data in supply chain monitoring	Improved product quality, cost reduction, faster adaptation to market changes
United States	Finance & Banking	AI for fraud detection, big data in credit scoring and risk analysis	More accurate credit assessments, reduced financial fraud, personalized customer services
Serbia	Energy Sector	Big data for energy consumption optimization, AI for predictive demand	Improved efficiency, better grid management, support for renewable energy integration
Japan	Automotive Industry	AI-embedded systems in vehicle design, big data in autonomous driving R&D	Increased innovation, progress toward autonomous vehicles, enhanced safety standards
Italy	Manufacturing (SMEs)	AI-assisted big data analytics for sustainability strategies	Reduced waste, improved circular economy practices, higher alignment with EU policies
India	Agriculture	AI-based crop prediction, big data weather forecasting	Increased crop yield, better risk management against climate variability
Global Trend	Healthcare & Pharma	AI in drug discovery, big data in personalized medicine	Faster drug development, tailored treatments, enhanced patient outcomes

Key Challenges and Risks

While the integration of artificial intelligence and big data into management models offers clear opportunities, it also brings a series of challenges and risks that organizations and policymakers must carefully address. These challenges are both technological and organizational, encompassing security, skills, and governance issues.

1. Data Security and Privacy

One of the most critical risks concerns the protection of sensitive data. AI and big data systems rely on massive volumes of personal, financial, and operational information, which makes them vulnerable to cyberattacks and data breaches. The lack of standardized global regulations further complicates compliance, creating uncertainty for organizations operating across borders.

2. Ethical and Legal Concerns

The use of AI in decision-making raises questions of accountability and fairness. Biased algorithms may lead to discriminatory practices, especially in finance, recruitment, or healthcare.

Legal systems often lag behind technological innovation, leaving organizations in ambiguous situations when it comes to responsibility for AI-driven outcomes.

3. Technological and Infrastructure Gaps

Not all industries or regions are equally prepared for digital transformation. Traditional industries in developing economies often face outdated infrastructure, weak digital connectivity, and limited investment capacity. These gaps restrict their ability to fully benefit from AI and big data innovations.

4. Skills and Workforce Adaptation

AI and big data demand a workforce with advanced technical and analytical skills. However, many organizations struggle with shortages of qualified data scientists, engineers, and digital strategists. At the same time, employees in traditional industries may resist change due to fears of job loss, requiring careful change management and retraining programs.

5. Organizational Resistance and Cultural Barriers

Digital transformation often challenges long-standing management practices and organizational hierarchies. Resistance to change, lack of trust in automated systems, and slow cultural adaptation can hinder the successful implementation of AI and big data technologies.

6. Financial and Implementation Costs

Although AI and big data promise long-term efficiency gains, the initial investment in infrastructure, software, and training can be substantial. For small and medium-sized enterprises (SMEs), the financial burden of adopting advanced technologies may outweigh the perceived short-term benefits.

7. Sustainability and Environmental Risks

The operation of large-scale data centers and AI systems requires considerable energy consumption. Without sustainable energy strategies, the ecological footprint of AI and big data may conflict with global goals for reducing carbon emissions.

In addressing these challenges, organizations need to adopt comprehensive strategies that combine technological safeguards with ethical frameworks, employee development, and sustainable practices. Policymakers should create regulatory environments that protect consumers while encouraging innovation, ensuring that the digital transformation of management models remains both effective and responsible.

Conclusion

The integration of artificial intelligence and big data into management models is transforming the relationship between the digital economy and traditional industry. This transformation is not simply about the adoption of new technologies but involves a comprehensive reconfiguration of organizational structures, decision-making processes, and business strategies. AI and big data provide unprecedented capabilities for real-time analysis, predictive insights, and adaptive management, enabling enterprises to move beyond the limitations of traditional hierarchical systems.

The theoretical foundations of the digital economy highlight the centrality of data as a production factor and underscore the role of AI as a key enabler of innovation and efficiency. Practical applications across diverse industries – from manufacturing and energy to finance and healthcare – demonstrate the capacity of AI and big data to improve productivity, reduce costs, and support

sustainability goals. At the same time, these technologies encourage the development of new management models characterized by flexibility, agility, and knowledge-based decision-making.

Nevertheless, challenges remain significant. Issues of data security, privacy, ethical responsibility, and organizational resistance to change cannot be overlooked. The success of digital transformation depends not only on technological readiness but also on leadership vision, effective change management strategies, and investment in human capital. Countries and organizations that foster digital skills, encourage innovation, and create supportive regulatory frameworks will be better positioned to take full advantage of these emerging opportunities.

In conclusion, AI and big data are powerful drivers of economic modernization and industrial integration. They serve as bridges between digital and traditional systems, enabling a new era of smart, sustainable, and globally competitive industries. The path forward requires balancing technological innovation with responsible governance, ensuring that the digital transformation of management models contributes to long-term economic growth and societal well-being.

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ARTIFICIAL INTELLIGENCE AND BIG DATA IN THE TRANSFORMATION OF MANAGEMENT MODELS FOR THE DIGITAL ECONOMY AND TRADITIONAL INDUSTRY INTEGRATION

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Abstract. The rapid development of artificial intelligence (AI) and big data technologies has become a decisive factor in the transformation of management models across different industries. Their integration into traditional industries enables the digital economy to accelerate innovation, optimize decision-making processes, and increase efficiency at multiple organizational levels. This paper explores the role of AI and big data in reshaping management models, focusing on how digital tools enhance industrial competitiveness, support sustainable development, and enable the convergence of digital and traditional economic structures. Emphasis is placed on practical applications, potential challenges, and strategies for balancing technological innovation with organizational adaptation.

Key words: artificial intelligence, big data, digital economy, management models, industrial transformation, innovation, sustainable development.