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КАК ИСКУССТВЕННЫЙ ИНТЕЛЛЕКТ ТРАНСФОРМИРУЕТ ПРИНЦИПЫ ПРИНЯТИЯ УПРАВЛЕНЧЕСКИХ РЕШЕНИЙ В УСЛОВИЯХ ЦИФРОВОЙ ТРАНСФОРМАЦИИ ТРАДИЦИОННЫХ ПРОИЗВОДСТВЕННЫХ СИСТЕМ

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Аннотация. С быстрым развитием цифровых технологий искусственный интеллект превратился в ключевую силу, изменяющую традиционные производственные системы и переосмысливающую принципы принятия управленческих решений. В контексте цифровой экономики традиционные способы производства, характеризующиеся линейными процессами, суждениями, основанными на опыте, и иерархическим управлением, претерпевают глубокую трансформацию в сторону интеллектуальных, управляемых данными и адаптивных систем. Технологии искусственного интеллекта, такие как машинное обучение, анализ больших объемов данных, интеллектуальная автоматизация и системы поддержки принятия решений, превратились из вспомогательных инструментов в стратегические компоненты, глубоко встроенные в организационные структуры принятия решений. В этой статье рассматривается, как искусственный интеллект трансформирует основные принципы принятия управленческих решений в ходе цифровой трансформации традиционных производственных систем, подчеркивая переход от принятия решений, основанных на интуиции, к подходам, основанным на фактических данных и управляемым данными, от статического планирования к динамической оптимизации и от централизованного управления к алгоритмическому и децентрализованные модели принятия решений. Кроме того, в исследовании анализируются возможности и проблемы, возникающие в связи с внедрением искусственного интеллекта, включая повышение эффективности и точности принятия

решений, а также этические риски и проблемы управления. Объединяя теоретические идеи с практическими выводами, это исследование способствует более глубокому пониманию того, как искусственный интеллект изменяет логику управления и поддерживает устойчивую конкурентоспособность в цифровой экономике.

Ключевые слова: искусственный интеллект, принятие управленческих решений, цифровая экономика, интеллектуальные производственные системы, управление на основе данных, организационная трансформация, алгоритмическое управление.

1. Introduction

The rapid expansion of the digital economy has fundamentally reshaped the operational environment of modern enterprises, placing unprecedented pressure on traditional production systems and managerial structures. Production models that once relied on standardized processes, predictable demand, and hierarchical control mechanisms are increasingly challenged by technological acceleration, market uncertainty, and growing informational complexity. Digital technologies now penetrate every stage of value creation, forcing organizations to reconsider not only how production activities are organized but also how managerial decisions are conceived and implemented. Within this context, artificial intelligence has emerged as a core enabling technology that redefines managerial cognition and organizational decision logic 0.

Traditionally, managerial decision-making was largely grounded in human expertise, experiential knowledge, and limited historical data. While such approaches were effective in relatively stable industrial environments, they reveal structural limitations in data-intensive and rapidly evolving digital ecosystems. Managers are now required to interpret vast volumes of real-time data, respond to complex interdependencies, and make decisions under heightened uncertainty. AI-driven technologies, such as machine learning, predictive analytics, and intelligent algorithms, extend managerial capabilities by processing large-scale and heterogeneous datasets, uncovering hidden patterns, and generating forward-looking insights that exceed human cognitive capacity 1.

As AI becomes increasingly embedded within production systems and organizational processes, managerial roles are undergoing a significant transformation. Decision-making authority is gradually shifting from purely human-centered models toward hybrid configurations characterized by human–AI collaboration. In such arrangements, AI systems provide analytical recommendations and scenario evaluations, while managers remain responsible for strategic judgment, ethical oversight, and contextual interpretation. This evolution signifies a transition from intuition-based and reactive decision-making toward data-driven, predictive, and adaptive decision frameworks,

fundamentally reshaping the principles of managerial control and responsibility in digitally transformed production systems 2.

2. Digital Economy and the Transformation of Traditional Production Systems

The digital economy is defined by the pervasive application of digital technologies to the creation, processing, and exchange of information, fundamentally altering the foundations of industrial production and organizational coordination. In this environment, data functions as a core strategic asset, while digital platforms increasingly shape value creation, resource allocation, and inter-organizational interaction. Traditional production systems – historically designed around economies of scale, rigid process structures, and standardized outputs – are progressively transitioning toward more flexible, intelligent, and interconnected configurations capable of responding to dynamic market conditions 3.

The digital transformation of production systems is driven by the integration of advanced technologies such as the industrial Internet of Things, cloud computing, artificial intelligence, and cyber-physical systems. These technologies enable real-time data acquisition, predictive maintenance, and adaptive production scheduling, thereby enhancing operational responsiveness and system resilience. As a result, production activities are no longer isolated operational units but components of continuously evolving ecosystems that interact with suppliers, customers, and markets in real time. This systemic transformation leads to increased interdependence and operational complexity, requiring new managerial approaches to coordination and control 4.

The growing complexity generated by digitally connected production systems significantly intensifies the demands placed on managerial decision-making. Managers must interpret multidimensional data streams, respond rapidly to environmental volatility, and coordinate decision processes across organizational and network boundaries. In this context, artificial intelligence serves as a critical enabler by providing advanced analytical capabilities, processing speed, and predictive insights that extend beyond the limits of traditional decision-support tools. AI-assisted decision-making thus becomes essential for managing complexity and sustaining competitiveness in digitally transformed production systems.

3. Artificial Intelligence as a New Foundation for Managerial Decision-Making

Artificial intelligence has fundamentally transformed the informational foundations upon which managerial decision-making is constructed. In traditional managerial systems, decision-makers frequently faced limitations arising from fragmented datasets, delayed information flows, and restricted analytical capacity, leading to a strong dependence on intuition, experiential knowledge, and subjective judgment. In contrast, AI-driven analytical systems enable organizations to

continuously collect, integrate, and process real-time data across the entire value chain, significantly expanding the scope and depth of information available to managers 5.

Through the application of machine learning and advanced analytics, AI systems are capable of identifying complex patterns, forecasting demand variability, optimizing resource allocation, and simulating alternative decision scenarios under uncertain conditions. These capabilities fundamentally shift managerial decision-making from reactive responses toward proactive and predictive processes. Rather than relying primarily on personal experience, managers increasingly base decisions on algorithm-generated insights and data-driven evidence, enhancing both decision consistency and strategic foresight 6.

Moreover, artificial intelligence facilitates the integration of heterogeneous data sources, including structured operational data and unstructured information such as sensor inputs, customer feedback, market signals, and social media content. This comprehensive and multidimensional perspective improves decision accuracy, reduces uncertainty, and enhances the transparency and traceability of managerial actions. As a result, AI-supported decision-making not only improves organizational performance but also strengthens accountability and governance within increasingly complex digital enterprises 7.

4. From Human-Centered to Human–AI Collaborative Decision Models

The growing adoption of artificial intelligence does not diminish the role of managers; rather, it fundamentally redefines managerial functions and decision authority. Within AI-enabled production systems, managerial decision-making increasingly takes the form of collaborative interaction between human actors and intelligent technologies. While AI systems contribute analytical recommendations through pattern recognition, prediction, and optimization, managers remain responsible for contextual interpretation, ethical evaluation, and strategic direction. This human–AI collaboration reflects a shift from purely human-centered decision-making toward hybrid decision models that integrate algorithmic intelligence with managerial judgment 0.

As decision-support systems become more sophisticated, managerial attention progressively shifts away from routine operational control toward higher-level responsibilities, including strategic alignment, innovation management, and organizational learning. Managers increasingly function as interpreters of algorithmic outputs, translating complex analytical results into actionable strategic decisions, while simultaneously acting as custodians of organizational values and long-term objectives. Decision authority is no longer concentrated solely within hierarchical managerial structures but becomes distributed across interconnected human and technological agents, forming dynamic and adaptive decision architectures 7.

Despite its potential benefits, the transition toward human–AI collaborative decision models introduces significant managerial challenges. Excessive reliance on algorithmic recommendations may weaken managerial autonomy and reduce critical reflection, particularly when decision-makers defer judgment to automated systems. Furthermore, the opacity of «black-box» algorithms can undermine trust, accountability, and transparency if the rationale underlying algorithmic decisions remains unclear. Consequently, effective human–AI collaboration requires the development of new managerial competencies, including data literacy, the ability to critically assess algorithmic outputs, and a strong commitment to ethical and governance frameworks that ensure responsible and explainable AI use within organizations.

5. AI-Driven Decision-Making in Intelligent Production Systems

Within intelligent production systems, artificial intelligence has become a central mechanism shaping both operational and strategic decision-making processes. At the operational level, AI technologies enable real-time data processing, automated feedback loops, and continuous optimization of core production activities. By integrating sensor data, machine logs, and supply chain information, AI systems optimize production planning, quality control, inventory management, and logistics coordination. Predictive maintenance algorithms, for example, analyze equipment performance patterns to anticipate potential failures before they occur, significantly reducing downtime, maintenance costs, and production disruptions while improving overall operational efficiency 8.

Beyond operational optimization, AI plays an increasingly important role in strategic decision-making within intelligent production systems. Advanced analytics and simulation-based models support managerial decisions related to capacity planning, capital investment, supplier selection, and market expansion. Through scenario analysis and digital twin technologies, managers can evaluate the long-term implications of strategic choices under varying demand conditions, technological trajectories, and risk environments. This capability enhances strategic foresight, reduces uncertainty, and strengthens organizational resilience in highly volatile and competitive markets 9.

Furthermore, AI-driven decision-making facilitates a shift from centralized control toward decentralized and network-based governance structures within production systems. By embedding localized intelligence at the level of production units, machines, and frontline teams, AI enables autonomous and adaptive decision-making closer to the point of action. Rather than relying exclusively on top-down managerial directives, organizations can leverage AI-enabled systems to support distributed decision authority across production networks. This decentralization enhances

responsiveness, accelerates innovation cycles, and improves the ability of production systems to adapt to local disruptions and customer-specific requirements 10.

Taken together, AI-driven decision-making transforms intelligent production systems into dynamic, self-regulating, and learning-oriented organizational structures. While managerial oversight remains critical, AI increasingly functions as a strategic partner in coordinating complex production activities, aligning operational execution with long-term strategic objectives, and sustaining competitiveness in the digital economy.

Table 1

Representative Cases of AI-Driven Decision-Making in Intelligent Production Systems

Industry / Company Type	AI Application Scenario	Decision Level	Decision-Making Function	Main Outcomes
Automotive Manufacturing (e.g., Smart Assembly Plants)	Predictive maintenance based on machine learning algorithms	Operational	Equipment maintenance scheduling and fault prediction	Reduced downtime, lower maintenance costs, increased production efficiency
Electronics Manufacturing Enterprises	AI-based quality inspection using computer vision	Operational	Real-time defect detection and quality control decisions	Improved product quality, reduced defect rates, faster inspection cycles
Global Manufacturing Firms with Digital Twins	Simulation-based capacity planning and scenario analysis	Strategic	Long-term capacity expansion and investment decisions	Reduced strategic uncertainty, improved resilience and risk preparedness
Process Manufacturing (e.g., Chemicals, Energy)	AI-driven demand forecasting and production optimization	Strategic	Production planning and resource allocation	Enhanced supply-demand matching, improved cost efficiency
Distributed Manufacturing Networks	AI-enabled decentralized decision support systems	Hybrid (Operational & Strategic)	Localized scheduling and coordination across production units	Increased responsiveness, innovation capacity, and system adaptability

Analysis of AI-Driven Decision-Making Cases

The cases presented in Table 1 illustrate how artificial intelligence supports managerial decision-making across multiple levels within intelligent production systems. At the operational level, AI applications such as predictive maintenance and computer vision–based quality inspection enhance real-time responsiveness and operational efficiency. By enabling early fault detection and automated quality control, AI reduces human intervention in routine decision tasks while improving accuracy and consistency. These applications exemplify how AI shifts operational decision-making from reactive problem-solving toward proactive optimization.

At the strategic level, AI-driven tools such as digital twins, scenario simulation models, and advanced demand forecasting systems support long-term planning and investment decisions. By allowing managers to evaluate alternative strategic options under different market and risk conditions,

AI reduces uncertainty and strengthens organizational resilience. These capabilities are particularly valuable in volatile environments where traditional forecasting and planning methods are insufficient.

The table also highlights the growing importance of hybrid decision-making structures in distributed production networks. AI-enabled decentralized systems empower local production units with real-time intelligence while maintaining alignment with overarching strategic objectives. This redistribution of decision authority enhances organizational flexibility, accelerates innovation processes, and supports adaptive governance structures. However, these cases also imply the need for robust managerial oversight to ensure coherence, ethical compliance, and strategic consistency across human–AI decision frameworks.

Overall, the empirical relevance of these cases demonstrates that AI-driven decision-making is not confined to isolated technological upgrades but represents a systemic transformation of how intelligent production systems operate and how managerial decisions are conceived, executed, and governed in the digital economy.

6. Ethical, Organizational, and Governance Challenges

Despite its significant potential to enhance decision quality and operational efficiency, AI-driven decision-making also introduces a range of ethical, organizational, and governance challenges that cannot be overlooked. One of the most critical ethical concerns is algorithmic bias. When AI systems are trained on historical data that reflect existing inequalities, skewed representations, or systemic distortions, their outputs may reinforce unfair, discriminatory, or suboptimal decision outcomes. In managerial contexts, such biases may affect resource allocation, performance evaluation, and strategic prioritization, thereby undermining organizational legitimacy and social responsibility. Managers therefore bear the responsibility of ensuring that AI systems are designed, tested, and continuously monitored to promote fairness, transparency, and inclusivity 11.

Data security and privacy constitute another major challenge in AI-enabled production systems, particularly given their reliance on large-scale data collection across organizational boundaries. Intelligent production systems often integrate sensitive operational, employee, and customer data in real time, increasing exposure to cybersecurity risks, unauthorized access, and data misuse. Breaches or irresponsible data practices can erode stakeholder trust and expose organizations to regulatory and legal consequences. As a result, the implementation of robust data governance frameworks – covering data ownership, access control, accountability, and compliance – becomes a prerequisite for responsible and sustainable AI deployment in managerial decision-making 12.

From an organizational perspective, resistance to change represents a significant barrier to effective AI adoption. Employees may perceive AI technologies as threats to job security, professional autonomy, or established power structures within the organization. Such perceptions can

lead to skepticism, reduced cooperation, or active resistance, ultimately limiting the effectiveness of AI-enabled decision models. Addressing these challenges requires comprehensive change management strategies that emphasize transparent communication, employee involvement, and continuous skills development. By fostering data literacy and clarifying the complementary roles of humans and AI, organizations can align human resources with AI-driven decision systems and support a more inclusive and adaptive transformation process.

7. Implications for Contemporary Business Decision Making

The integration of artificial intelligence into managerial decision-making carries far-reaching implications for contemporary business practice and organizational governance. First, it necessitates a fundamental redefinition of managerial competencies. In AI-enabled organizations, effective decision-makers are no longer defined solely by domain expertise or accumulated experience, but increasingly by their ability to interpret data, collaborate with intelligent systems, and exercise ethical judgment. Digital literacy, analytical reasoning, and an understanding of algorithmic limitations become essential managerial capabilities, enabling managers to critically evaluate AI-generated insights rather than passively accept automated recommendations 13.

Second, organizations must redesign decision-making processes to achieve an appropriate balance between algorithmic efficiency and human judgment. While AI systems can enhance speed, consistency, and predictive accuracy, managerial oversight remains crucial for contextual interpretation, value-based reasoning, and accountability. Establishing transparent decision workflows, clearly defined responsibility structures, and explainable AI mechanisms is essential for maintaining organizational trust and legitimacy. Without such safeguards, organizations risk delegating critical decisions to opaque systems that undermine managerial responsibility and stakeholder confidence 14.

Conclusion

The rapid advancement of artificial intelligence has fundamentally reshaped the principles of managerial decision-making within the context of the digital transformation of traditional production systems. This study has examined how AI alters the informational foundations, decision-making structures, and managerial roles that underpin contemporary production and organizational management. By shifting decision processes from intuition-based and experience-driven approaches toward data-driven, predictive, and adaptive models, artificial intelligence enables organizations to operate more effectively in environments characterized by complexity, uncertainty, and rapid change.

The analysis demonstrates that AI-driven decision-making extends beyond operational efficiency improvements to influence strategic planning, organizational governance, and managerial

accountability. Through the integration of advanced analytics, machine learning, and intelligent automation, production systems evolve into interconnected and responsive ecosystems capable of continuous optimization and learning. At the same time, managerial roles transition from direct decision-makers to coordinators of human–AI collaboration, emphasizing strategic judgment, ethical oversight, and contextual interpretation.

However, the transformative impact of AI is accompanied by significant ethical, organizational, and governance challenges. Issues such as algorithmic bias, data security, transparency, and resistance to change highlight the necessity of responsible AI adoption. Effective managerial decision-making in the digital economy therefore requires not only technological capability, but also robust governance frameworks, organizational alignment, and the development of new managerial competencies that balance algorithmic intelligence with human values and responsibility.

Overall, this study contributes to the growing body of research on artificial intelligence and managerial decision-making by clarifying how AI reshapes decision principles in intelligent production systems under the digital economy. By adopting a balanced approach that integrates technological innovation with ethical governance and human-centered management, enterprises can leverage AI as a strategic resource to enhance adaptability, innovation capacity, and long-term competitive advantage. Future research may further explore empirical evidence across industries and regions to deepen understanding of human – AI decision models and their evolving implications for managerial practice.

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HOW ARTIFICIAL INTELLIGENCE TRANSFORMS THE PRINCIPLES OF MANAGERIAL DECISION-MAKING AMID THE DIGITAL TRANSFORMATION OF TRADITIONAL PRODUCTION SYSTEMS

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Abstract. With the rapid advancement of digital technologies, artificial intelligence has emerged as a pivotal force reshaping traditional production systems and redefining the principles of managerial decision-making. In the context of the digital economy, conventional production modes characterized by linear processes, experience-based judgments, and hierarchical control are undergoing a profound transformation toward intelligent, data-driven, and adaptive systems. AI technologies such as machine learning, big data analytics, intelligent automation, and decision-support systems have evolved from auxiliary tools into strategic components deeply embedded within organizational decision structures. This paper examines how artificial intelligence transforms the core principles of managerial decision-making during the digital transformation of traditional production systems, emphasizing the shift from intuition-based decision-making to evidence-based and data-driven approaches, from static planning to dynamic optimization, and from centralized control to algorithm-assisted and decentralized decision models. In addition, the study analyzes the opportunities and challenges arising from AI adoption, including improved decision efficiency and accuracy, as well as ethical risks and governance concerns. By integrating theoretical insights with practical implications, this research contributes to a deeper understanding of how artificial intelligence reshapes managerial logic and supports sustainable competitiveness in the digital economy.

Key words: artificial Intelligence, managerial decision-making, digital economy, intelligent production systems, data-driven management, organizational transformation, algorithmic governance.