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Research on the Reconstruction of Tech-Economic Management Modes Driven by Artificial Intelligence and Big Data

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Abstract: *Against the backdrop of the in-depth integration of the digital economy and intelligent technologies, traditional techno-economic management is confronted with challenges such as decision-making lag and information silos. Meanwhile, enterprises are plagued by issues including rigid management systems, lagging technological applications, insufficient model innovation, and weak talent support. Based on relevant theories, this paper analyses the enabling mechanisms of artificial intelligence and big data, and constructs a four-dimensional reconstruction framework of "Concepts-Systems-Technologies-Talents". With collaborative linkage, this framework can promote the transformation of techno-economic management from experience-driven to data-intelligence-driven, enhance the scientificity of enterprise decision-making, operational efficiency, and value creation capacity, and provide paths for the modernization and sustainable development of enterprise management.*

Keywords: *Tech-economic Management; Artificial Intelligence; Big Data; Digital Transformation; Mode Reconstruction*

1. Introduction

1.1. Research Background

With the rapid development of emerging information technologies, next-generation information technologies such as artificial intelligence, the Internet of Things, cloud computing, and big data have been increasingly applied in enterprise management [1], driving the transformation of the techno-economic management model from traditional experience-driven to data-intelligence-driven. As a core link connecting technological innovation and economic returns, the scientificity of the techno-economic management model directly affects the efficiency of enterprise resource allocation and market competitiveness. Meanwhile, the modernization of enterprise management is an inevitable requirement for enterprises to respond to market changes and achieve sustainable development in the new era. Currently, some enterprises still face problems such as outdated management concepts, imperfect systems, low intelligence levels, and insufficient talent team development, making it difficult for them to adapt to the development needs of the digital age. Against this backdrop, artificial intelligence and big data, as important technological forces driving the modernization of enterprise management, are gradually penetrating all aspects of techno-economic management, promoting the systematic reconstruction of the management model from four dimensions: concepts, systems, technologies, and talents. This paper aims to construct a four-dimensional reconstruction framework of "Concepts-Systems-Technologies-Talents", systematically explain how artificial intelligence and big data drive the evolution of techno-economic management toward digitalization, intelligence, and collaboration, and provide theoretical support and practical paths for enterprises to realize management modernization.

1.2. Research Objectives and Significance

The core research objective of this paper is to systematically clarify the reconstruction mechanism of artificial intelligence and big data on the techno-economic management model, construct a scientific and feasible transformation framework, and provide theoretical support and practical paths for enterprises to achieve management modernization. Specifically, the research objectives include the following three levels:

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First, clarify the core connotations and essential requirements of techno-economic management and enterprise management modernization, define the core characteristics and development trends of both in the digital era, and lay a solid theoretical foundation for subsequent research. Meanwhile, this paper will comprehensively analyze the practical problems existing in current enterprises' techno-economic management, such as rigid management systems, lagging technological applications, insufficient model innovation, and weak talent support, so as to accurately identify the key pain points in the transformation process.

Second, deeply explore the core mechanism of action of artificial intelligence and big data in techno-economic management, reveal the operational logic of the four major mechanisms: data governance and value mining, intelligent decision-making empowerment, process automation and collaborative optimization, as well as personalized services and value creation, clarify how technology can effectively address the predicaments of traditional management, and provide technical logical support for model reconstruction.

Third, construct an integrated four-dimensional framework for the reconstruction of the techno-economic management model, namely "Concepts-Systems-Technologies-Talents", clarify the core content, implementation paths and collaborative relationships of each dimension, ensure that the framework has strong practical adaptability and operability, and guide enterprises to realize the transformation of techno-economic management from experience-driven to data-intelligence-driven.

In terms of theoretical significance, this paper focuses on the in-depth integration of technology and management in the digital era, systematically discusses the reconstruction mechanism of artificial intelligence and big data on the techno-economic management model, breaks through the limitations of traditional techno-economic management theories that focus only on technical elements, expands the research boundaries of this field in the context of digitalization and intelligence, and provides a new perspective for the theoretical system to keep pace with the times. By constructing the four-dimensional reconstruction framework of "Concepts-Systems-Technologies-Talents", this paper reveals the internal logic of interconnection and collaborative advancement among various dimensions, makes up for the deficiency that existing research mostly explores management optimization from a single dimension, and provides a systematic analytical framework for the theory of enterprise management modernization. This paper analyzes in detail the mechanism of action of artificial intelligence and big data in key links such as management decision-making, process operation, resource allocation and value creation, clarifies the transformation path of technology from tool application to model reconstruction, and provides a reference theoretical logic for subsequent research on the in-depth integration of technology and management.

In terms of practical significance, the four-dimensional reconstruction framework constructed in this paper responds specifically to the prominent problems of enterprises in management systems, technological applications, model innovation, talent development and other aspects, providing clear transformation guidance for enterprises. This framework guides enterprises to realize the transformation of techno-economic management from experience-driven to data-intelligence-driven, which can significantly improve the scientificity of decision-making, operational efficiency and value creation capacity. It helps enterprises accurately seize opportunities and effectively control risks in the rapidly changing market environment, form differentiated competitive advantages, and lay a solid foundation for sustainable development in the digital era. The research results of this paper are conducive to guiding enterprises to give full play to the technological advantages of artificial intelligence and big data, promote the in-depth integration of technological innovation and economic benefits, drive the coordinated evolution of management modernization and digital economic development, and provide strong support for the high-quality development and digital economic transformation of Chinese enterprises.

1.3. Literature Review

Existing research focuses on the core issues of techno-economic management and enterprise management modernization, forming different research dimensions. The literature distribution and core content of each dimension show distinct epochal characteristics and practical orientation.

Some scholars focus on the essential connotations of techno-economic management and enterprise management modernization, laying a theoretical foundation for subsequent research. Zhang Hao (2023) clarified that techno-economic management is a management process in which enterprises formulate technology and market development plans, optimize industrial structure, and rationally allocate resources to ultimately achieve goals under the established development objectives, emphasizing that its core lies

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in the coordinated optimization of technology and economy. Combining the scenario of power enterprises, Li Xin (2017) further expanded the industry-adaptive connotation of techno-economic management, pointing out that it is necessary to balance the dual goals of technical safety and economic efficiency in specific industries. As for enterprise management modernization, Song Yupu (2024) defined it as the innovation of management mode adapted to the needs of the modern market based on scientific organizational structure and relying on computer and Internet technologies, highlighting the core status of technological empowerment and concept upgrading.

Scholars generally pay attention to the prominent problems faced by enterprises in the process of promoting techno-economic management and management modernization. Li Jing (2025) pointed out that Chinese enterprises have a significant problem of insufficient localization adaptation in techno-economic management. Blindly copying Western management systems leads to disjointed processes and distorted implementation, which is difficult to support risk control and strategic expansion. Starting from the technical application level, Feng Yuli and Geng Wuhou (2021) found that a large number of enterprises, especially small and medium-sized ones, have the problem of lagging management technology. The informatization construction lacks systematic planning, the integration of technical tools and core business processes is not in-depth, and the effect of digital empowerment is not good. Li Weihao and Tang Jinlian (2019) emphasized the constraints of management concepts and talent teams, believing that the traditional experience-based management thinking is deeply rooted, and the shortage of high-quality compound talents seriously hinders the improvement of management modernization level. Yang Long et al. (2019) further supplemented the defects in the management system, pointing out that the vertical pyramid-shaped hierarchical structure leads to lengthy decision-making chains and serious data islands, making it difficult to adapt to the agile management needs of the digital era.

With the development of technologies such as artificial intelligence and big data, relevant research has gradually focused on the enabling role of technology in management models. Feng Yuli and Geng Wuhou (2021) analyzed in detail the application value of modern information technology in enterprise economic management, believing that the Internet and information tools can significantly improve management efficiency and quality, and provide technical support for the optimal allocation of resources. Yang Long et al. (2019) specially discussed the integration path of intelligent technology and economic management, proposing that intelligent control at the technical level and intelligent analysis at the economic level are the key directions to improve management efficiency. From a more macro perspective, Song Yupu (2024) emphasized the core role of emerging information technologies in driving the transformation of management models from experience-driven to data-driven, providing technical logical support for the modernization of enterprise management.

2. Theoretical Basis

2.1. Connotation of Tech-Economic Management

Enterprise tech-economic management refers to the management process in which enterprises formulate development plans for technology and the market based on clear operational and development goals, implement these plans in practical management, comprehensively optimize the industrial structure, rationally utilize resource allocation, abide by corresponding rules and regulations, and ultimately ensure the smooth achievement of relevant goals [2]. In the specific management process, it is also necessary to base on reality and fully recognize the importance of AI, big data, and various new information technology means. Tech-economic management emphasizes maximizing economic benefits in the process of technological R&D, application, and iteration, covering links such as technology evaluation, resource allocation, cost control, and risk early warning. Its core goal is to maximize the value of technological innovation, optimize the efficiency of resource utilization, and achieve sustained growth of enterprise benefits by optimizing the coordination mechanism between technology and economy. Traditional tech-economic management modes are characterized by experience-based decision-making and hierarchical management, while tech-economic management modes in the digital age emphasize data as the core driving factor, relying on intelligent technologies to achieve the automation of management processes, the precision of decision-making, and the diversification of value creation.

2.2. Essential Requirements of Enterprise Management Modernization

Enterprise management modernization refers to the establishment of a modern management mode that meets the requirements of the times by scientifically setting up enterprise organizational structures

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and using computer technology and Internet technology on the basis of scientific methods [3]. Its essence is to adapt to technological progress and market changes through management innovation. The core requirements include establishing a modern management concept centered on customers and driven by data, building a flat and flexible management system, strengthening the in-depth integration of information technology and management business, and cultivating a high-quality team of compound talents. In the context of AI and big data, the core characteristics of enterprise management modernization are reflected in intelligence, digitization, and coordination.

3. Current Status of Enterprise Tech-Economic Management Modes and Enterprise Management Modernization Development

3.1. Lack of Systematic Management Systems, Rigid Structures Restrict Efficiency

The key to promoting enterprise management modernization lies in building a scientific, complete, and efficient management system. However, many enterprises are still trapped in the traditional bureaucratic system, adopting a vertical pyramid-shaped management structure. This structure often leads to lengthy decision-making chains, attenuation of information transmission, and excessive reliance on top-level decision-making. Once strategic misjudgment or slow market response occurs, it is likely to cause systemic risks and significant economic losses. Especially in the digital age, this rigid system is often disconnected from the requirements of data-driven agile management, with deep departmental barriers and serious information silos, making it difficult to form a cross-functional collaborative management synergy, which fundamentally restricts the evolution of enterprise tech-economic management towards systematization and modernization.

3.2. Lagging Application of Management Technologies, Insufficient Digital Empowerment

With the expansion of enterprise scale and the improvement of business complexity, higher requirements are put forward for the advancement of management technologies. Although new-generation information technologies such as cloud computing, big data, and AI have become increasingly mature and demonstrated great potential in many industries, a considerable number of enterprises still rely on traditional management methods. These enterprises either lack systematic informatization construction plans or fail to deeply integrate some introduced technical tools with core business processes, resulting in outdated tech-economic management schemes and weak data analysis capabilities. Especially in technology-intensive industries, the lagging application of management technologies not only directly affects operational efficiency and cost control but also weakens the enterprise's adaptability and growth momentum in the rapidly changing market.

3.3. Lack of Innovation in Management Modes, Insufficient Local Adaptation

Against the background of the continuous innovation of global management ideas and practices, Chinese enterprises actively learn from advanced international experiences. However, in the field of tech-economic management, although Chinese enterprises are good at learning, they often directly copy Western management systems without integrating them with domestic actual conditions and national conditions, lacking innovative reforms. This leads to frequent problems in management practice, and enterprises' capabilities in risk response and market expansion are also insufficient [4]. This lack of innovative transformation and local adaptation makes the management system often disjointed in processes and distorted in implementation during actual operation, which is difficult to effectively support enterprises' risk control and strategic expansion, let alone form a sustainable competitive advantage.

3.4. Slow Update of Management Concepts, Weak Support from Professional Talents

The deep constraint of management modernization lies in concepts and talents. Currently, high-quality and compound professional talents in China's tech-economic management field are still relatively scarce, and most of them are concentrated in leading enterprises. A large number of small and medium-sized enterprises, especially some enterprises still with family-style management characteristics, are facing a serious talent shortage. Enterprises need to fully tap the introduction of excellent employees. Especially in the process of enterprise economic informatization management, it is necessary to continuously strengthen the professional training of employees on the basic application of economic

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information management technologies to ensure that employees can better proficiently apply enterprise information management technologies in the future [5]. The lack of guidance from scientific management ideas and corporate culture not only makes it difficult to attract and retain core talents but also leads to low efficiency of enterprise resource allocation and potential risks to asset security, which fundamentally hinders the improvement of management modernization.

4. Mechanisms of Action of Artificial Intelligence and Big Data in Tech-Economic Management

AI and big data technologies provide systematic technical support for the modern transformation of tech-economic management modes by reshaping management decision-making logic, optimizing resource allocation paths, and promoting cross-departmental collaboration. With data factorization, intelligent analysis, and scenario-based application as the main threads, the two form a synergistic mechanism in key links such as management decision-making, process operation, resource allocation, and value creation. They not only directly address the practical problems mentioned above, such as backward management systems and insufficient technology application but also lay a technical logic and practical foundation for the subsequent proposal of the reconstruction framework.

4.1. Data Governance and Value Mining Mechanism

Big data technology comprehensively integrates and deeply governs multi-source data inside and outside enterprises, solving the problems of information fragmentation and asymmetry in traditional management from the source. In the data collection link, structured and unstructured data are collected in real-time through multiple channels such as the IoT and business systems; in the data processing link, data quality and availability are ensured through cleaning, standardization, and distributed storage; in the value mining link, correlation analysis and clustering models are used to reveal the inherent laws between technical input and economic output, providing empirical basis for management decision-making and promoting the formation of a modern management concept driven by data.

4.2. Intelligent Decision-Making Empowerment Mechanism

AI technology promotes the transformation of management decision-making from experience-dependent to data-based scientific decision-making with the help of machine learning and simulation. At the strategic level, scenario simulation is carried out by integrating multi-dimensional data such as industry, competition, and technology to assist enterprises in judging technical routes and market layouts, reducing the risk of strategic misjudgment; at the operational level, real-time data monitoring and algorithm models are relied on to dynamically optimize daily decisions such as R&D management and cost control. This not only requires enterprises to establish a data-driven decision-making culture but also forces the management system to adjust towards flatness and agility.

4.3. Process Automation and Collaborative Optimization Mechanism

AI and big data promote the transformation of management modes from hierarchical and manual-oriented to flat and intelligently collaborative through process automation and dynamic optimization. Enterprises use technologies such as digital twins and process mining to identify bottleneck links and continuously optimize process design and resource allocation; at the same time, the construction of cross-departmental data platforms promotes information sharing and business collaboration, providing an implementation path for the evolution of the management system towards networking and platformization.

4.4. Personalized Service and Value Creation Mechanism

AI and big data support enterprises to extend from standardized management to personalized services, further expanding the value creation space of tech-economic management. Internally, personalized training and incentive schemes are formulated by analyzing employee data to improve the effectiveness of talent management; externally, customized products and services are provided based on user behavior data to enhance customer experience and value recognition. This mechanism promotes the transformation of enterprise management concepts towards customer-centricity and data-enabled value deepening, and also promotes the collaborative innovation of technical systems and service modes.

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5. Reconstruction Framework of Tech-Economic Management Modes Driven by Artificial Intelligence and Big Data

Based on the above mechanisms of action, AI and big data not only provide technical tools for enterprise tech-economic management but also drive profound changes in its concept, organization, technology, and talent structure at the system level. Therefore, this paper constructs a four-in-one management mode reconstruction framework of "Concept Reconstruction-System Reconstruction-Technology Reconstruction-Talent Reconstruction". With data and intelligence as the main thread, each dimension is connected and progresses collaboratively, jointly promoting the transformation of tech-economic management towards digitization, intelligence, and flexibility.

5.1. Concept Reconstruction: Forming a Data-Driven and Intelligently Collaborative Management Concept

Concept reconstruction is the forerunner of management mode reform, aiming to promote enterprises to establish management thinking compatible with the digital age from top to bottom. Specifically, concept reconstruction includes regarding data resources as key production factors, promoting the in-depth integration of technological innovation and economic benefits with data support, advocating an open, agile, and error-tolerant innovation culture, and supporting cross-departmental and cross-border collaboration and rapid iteration. Enterprises should fully recognize that the efficiency of management and the solidification of processes essentially need to be achieved through informatization and modernization methods. Especially in order to better improve the comprehensive benefits of enterprises and improve the overall economic situation of enterprises, enterprises need to update management concepts in a timely manner, innovate management modes, and actively apply various new management measures.

5.2. System Reconstruction: Building a Flat and Agile Management Structure and System

System reconstruction is the organizational and institutional guarantee for the implementation of concepts, aiming to break the efficiency bottlenecks and collaborative obstacles under the traditional bureaucratic system. For enterprise tech-economic management and modern management, constructing a sound and scientific management system and establishing a complete and detailed management system are extremely important work contents. In terms of organizational structure, it is necessary to promote the transformation from a vertical structure to a flat and networked one, set up special departments for data management and intelligent innovation, and improve the efficiency of cross-functional collaboration; in terms of system design, it is necessary to establish and improve data governance norms, innovation incentive measures, and agile assessment mechanisms, especially incorporating data application effects and intelligent contributions into the performance evaluation system; in terms of process mechanisms, it is necessary to realize the dynamic optimization of resource allocation based on data analysis, forming a closed-loop management of "data feedback-decision adjustment-resource reorganization".

5.3. Technology Reconstruction: Building an Intelligent Technology Support System

Technology reconstruction is the material foundation for the operation of management modes, and the key lies in building a unified, secure, and scalable technical platform. On the one hand, enterprises should strive to strengthen the construction of new-generation information infrastructure with AI and big data as the core, focusing on deploying system platforms and software tools for intelligent analysis and decision support, so as to provide a solid and cutting-edge technical support for the modern transformation of tech-economic management. On the other hand, building an intelligent management mode is an important development direction of enterprise tech-economic management. Both intelligent control and processing at the technical level and intelligent analysis and processing at the economic level will significantly improve management quality and efficiency [6]. It is necessary for enterprises to innovate tech-economic management modes and promote the upgrading and application of intelligent management modes.

5.4. Talent Reconstruction: Cultivating a Compound Team

Talent reconstruction is the fundamental support to ensure the effective implementation of concepts, systems, and technologies. In the process of economic management innovation, enterprises should change traditional management concepts. Scientific management can promote the development of

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enterprises. Among them, the comprehensive quality of enterprise managers has a profound impact on the quality of enterprise management and the future development of enterprises [7]. Enterprises need to systematically construct a compound talent training system, improve the data literacy and intelligent technology application capabilities of existing personnel through internal training, university-enterprise cooperation, and special introduction, and supplement new forces with both technical background and management experience. In terms of incentive mechanisms, enterprises should establish a salary distribution and promotion channel that reflects data contributions and innovation value to stimulate talent vitality. At the same time, they should actively create an organizational atmosphere that encourages learning and tolerates mistakes, providing a soft environment for talents to exert their value.

6. Conclusions and Prospects

6.1. Conclusions

Based on the era background of the in-depth integration of the digital economy and intelligent technologies, this paper focuses on the multiple dilemmas faced by traditional tech-economic management modes, such as rigid systems, backward technology, rigid modes, outdated concepts, and talent shortages. It systematically explores the core mechanisms of action of AI and big data in tech-economic management and constructs a four-dimensional reconstruction framework of "Concept-System-Technology-Talent". Among them, concept reconstruction is the core premise, breaking traditional cognitive stereotypes by establishing data-driven and collaborative innovation thinking; system reconstruction is the organizational guarantee, adapting to technology application and concept implementation with a flat structure and improved systems; technology reconstruction is the core carrier, building a "data + intelligence" technical support system to improve management efficiency; talent reconstruction is the key support, building a compound talent team to provide human resources guarantee for the reconstruction of each dimension. The four are interrelated and form a closed loop, ensuring that the effect of technological empowerment is fully transformed into the achievements of management modernization. The reconstruction framework has strong practical adaptability. Through the collaborative advancement of concept innovation, system optimization, technology upgrading, and talent building, enterprises can effectively solve the dilemmas of traditional management, realize the transformation of tech-economic management from experience-driven to data-intelligence-driven, and while improving the scientificity of decision-making, process efficiency, and value creation capacity, promote the comprehensive improvement of the level of enterprise management modernization, laying a foundation for the sustainable development of enterprises in the digital age.

6.2. Prospects

With the continuous iteration and in-depth penetration of digital technologies such as AI and big data, the reconstruction of tech-economic management modes will present a more diversified, intelligent, and collaborative development trend. In the future, further in-depth exploration can be carried out from the following aspects:

First, expanding the depth of technology integration. Currently, technology application is mainly dominated by single technology empowerment. In the future, it is necessary to strengthen the cross-technical integration of AI, big data with cloud computing, blockchain, digital twins, and other technologies, building a more complex and intelligent management technology ecosystem.

Second, conducting refined research on industry adaptability. Different industries have significant differences in tech-economic characteristics and management pain points. For example, the manufacturing industry focuses on production process optimization and supply chain management, the service industry focuses on customer service and value mining, and the high-tech industry emphasizes R&D innovation and risk control. In the future, aiming at the particularities of different industries, it is necessary to refine the implementation paths and key indicators of the reconstruction framework, develop industry-customized management modes and technical solutions, and improve the practical adaptability of research results.

Third, constructing a long-term iterative mechanism. The reconstruction of tech-economic management modes is not a one-time project but a dynamic process that needs to adapt to technological development, market changes, and enterprise growth. In the future, it is necessary to explore a long-term iterative mechanism of management modes, establish a continuous optimization system based on data feedback, and through real-time monitoring of reconstruction effects and dynamic adjustment of

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implementation strategies, promote the collaborative evolution of management modes with technological development and enterprise strategies, ensuring that enterprises maintain a competitive advantage in the rapidly changing digital age.

In conclusion, the reconstruction of tech-economic management modes driven by AI and big data is an inevitable path for enterprises to achieve management modernization. In the future, it is necessary to continuously deepen the integration logic of technology and management in theoretical research, and constantly optimize the reconstruction path in practical applications, promoting the in-depth integration of technical value and management value, so as to provide strong support for the high-quality development of enterprises and the transformation of the digital economy.

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