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Research on the Impact of Data Governance on the Digital Transformation of China's Manufacturing Industry

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Abstract

With the rapid development of information technology, China's manufacturing industry is in a critical period of digital transformation. Data governance, as an effective means of managing data assets, has a profound impact on the digital transformation of the manufacturing industry through DAMA's data management knowledge system and the Chinese national standard DCMM. This article deeply analyzes the positive impact of data governance on the digital transformation of China's manufacturing industry, including improving data quality, ensuring data security, optimizing business processes, promoting data sharing and collaboration, and driving intelligent decision-making in the data management system and data value system. Explored the practice and application of data governance and data asset management in China's manufacturing industry, with the aim of studying the impact of data management on the manufacturing industry. This article introduces the development trends of data management in the world, and the research results can be applied to the digital transformation of various industries based on China's data management experience, and corresponding response strategies are proposed.

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Keyword

DAMA, Data governance, digital transformation, manufacturing, data asset management, DCMM, artificial intelligence, technological innovation, data security.

Introduction

China's manufacturing industry occupies an important position in the global economic landscape, and in recent years, digital transformation has become a key strategy for enhancing competitiveness and achieving sustainable development in the manufacturing industry. In the process of digital transformation, enterprises generate and accumulate massive amounts of data, which contain enormous value. However, issues such as the complexity, diversity, and quality of data also arise. As a systematic data management system, data governance aims to ensure the availability, integrity, security, and compliance of data. How data governance empowers enterprise business and management, and how the data value system solves production and management problems, improves efficiency, has an undeniable impact on the digital transformation of China's manufacturing industry.

Analysis of research topics

Scientists such as Русаков С. А consider innovation issues in the development of industry and manufacturing in their works. Квинт В.Л., Li Bacon, Liu Baicheng, Guo Chongqing, Tan Jianrong.

Committed to innovation in data security or industrial technology, Грузков И.В., Грузков И.В., Скиперская Е.В., Русановский Е.В., Li Bohu.

Data Governance is a set of management behaviors involved in the use of data within an organization. Initiated and implemented by the enterprise data governance department, a series of policies and processes on how to develop and implement commercial applications and technical management for the entire internal data of the enterprise. Here are two standards and systems that have significant influence in China:

DAMA's Data Management Body of Knowledge (DMBOK) includes 11 data management functions, including data governance, data architecture, data modeling and design, data storage and operation, data security, data integration and interoperability, document and content management, reference data and master data management, data warehousing and business intelligence, metadata management, and data quality management [DAMA, 2020].

DCMM (Data Management Capability Maturity Assessment Model) is a national standard in the field of data management in China [Standardization Administration of China, 2018]. It analyzes and summarizes data management capabilities according to organization, system, process, and technology, and extracts eight process areas of organizational data management, namely: data strategy, data governance, data architecture, data application, data security, data quality management, data standards, and data lifecycle [ЧжанЦзяньхуа, 2024].

Research Results and Discussion

The definition given by the International Data Management Association (DAMA) is that data governance is a collection of activities that exercise power and control over data asset management [Li Sihai, 2023]. Data governance is crucial for ensuring accurate, moderate sharing, and protection of data. Effective data governance plans will return value to the business through improved decision-making, cost reduction, risk reduction, and increased security compliance, ultimately resulting in increased revenue and profits [DAMA International, 2009].

The manufacturing industry is the key foundation of the real economy, and in the process of digital transformation and moving towards intelligent manufacturing, it has more stringent requirements for data governance. With the help of data governance methods, manufacturing enterprises can achieve

real-time monitoring and in-depth analysis of the entire production process data, thereby optimizing the production process, improving production efficiency, and reducing operating costs. Industrial Internet is considered as a factor for developing industrial structure through digitalization and process integration and synchronization using software tools and technologies in the context of Industry 4.0 [ГрубковИ. В, 2021]. In the intelligent manufacturing workshop, the industrial Internet covers the results of the integration of industrial systems with advanced computing, analysis, induction technology and Internet connectivity. With the help of IoT technology, important data such as device operation status and product quality can be collected, and big data analysis technology can be used to make intelligent decisions, thereby achieving precise control of the production process and quality traceability. In the context of the digital economy, data has become a core strategic resource for manufacturing enterprises, and efficient data governance will also become a key driving force for enterprises to achieve sustainable development.

The rapid development of intelligent data governance technology is reshaping the overall pattern of data management with unprecedented strength. Proactively accepting cutting-edge technologies such as artificial intelligence, big data, blockchain, and data security is an inevitable requirement for enterprises to achieve the transformation of data governance towards intelligence.

1. Artificial intelligence technology enhances data governance efficiency, and the deep integration of the two brings revolutionary changes [Peng Lihui, 2024]. Algorithms such as natural language processing and machine learning enable artificial intelligence systems to automatically recognize and classify massive amounts of data, improve data processing efficiency and accuracy, reduce manual burden, and lower the risk of human error. Artificial intelligence can also perform intelligent analysis and prediction according to rules and models, providing precise business and strategic support for enterprises.

2. Big data technology is the core driver of data governance. The rapid development of information technology has become a key engine for the growth of the data governance industry. Its popularization enhances the scientific and accurate decision-making of enterprises, innovates governance models, and accelerates market maturity and prosperity. The powerful data processing capability enables enterprises to gain insights into massive amounts of data, integrate data resources, deeply mine and finely analyze data to discover opportunities and growth points. The continuous optimization and upgrading of big data will continue to inject vitality into the industry

3. As the "oil" of the new era, data has both value and risk. The circulation and use of data can greatly improve resource allocation efficiency, promote the vigorous development of new industries and formats. At the same time, blockchain is a distributed ledger technology with characteristics such as decentralization, immutability, transparency, etc. [Bucher, 2024]. Blockchain technology provides solid guarantees for the immutability and traceability of data, and provides strong guarantees for the secure storage and sharing of data.

The global cybersecurity threat situation remains severe, with serious cyber attacks never stopping. The threat of data theft and privacy breaches poses a huge threat to various industries. An attack refers to an attempt to destroy, disclose, modify, prevent, steal, gain unauthorized access to, or use assets. The most important asset is the information owned by individuals and organizations. Enterprises need to strengthen data security protection, including daily financial costs, process formula data, equipment technical parameter data, technology research and development and other production and operation data, as well as external sharing and interaction of suppliers, customers and consumers' names, contact information, address information, prices, payment account information, consumer behavior and other privacy data. Advanced encryption technology, access control policies and data anonymization measures should be adopted to ensure that the confidentiality, integrity and availability of data are not

compromised. Building a comprehensive data security protection system, sound data protection regulations, and strengthening privacy protection capabilities have become the primary tasks of the data governance industry.

With the frequent occurrence of data breaches and increasingly strict regulations, strengthening data privacy protection and security management will become an important trend in data governance. While strengthening data sharing, governments around the world also attach great importance to data security. The White House has released the Federal Data Strategy and 2020 Action Plan, elevating the development of "data as a strategic resource" to a national data strategy; The General Data Protection Regulation (GDPR) of the European Union grants EU residents control over their personal data to strengthen data management and protection [EU Data Protection Officer, 2018]; The European Data Governance Regulation emphasizes the promoting role of data sharing in economic development [European Parliament and of the Council, 2022].

The Chinese government has introduced a series of policies and regulations related to data governance, which have put forward stricter requirements for enterprise data management and use, clarified the requirements for data security and privacy protection, and provided legal basis for the compliant development of the data governance industry. The Chinese government and departments have also strengthened the formulation and implementation of regulations on data governance. Starting from 2021, multiple data laws have been issued to ensure data security and promote the healthy development of the digital economy.

-Data Security Law of the People's Republic of China

-Personal Information Protection Law of the People's Republic of China

-Guidelines for the Construction of Industrial Data Security Standard System (2023 Edition)

-Standardization of Data Security in the Industrial and Information Technology Fields (Trial)

The value system of data governance in the digital transformation of China's manufacturing industry is reflected in the fact that accurate and complete data is the fundamental value, providing support for operations; The value of decision-making is reflected in the basis of strategic and operational decision-making; Innovative value drives product and process innovation; Collaborative value promotes industrial upstream and downstream as well as ecological synergy; The security value protects the core assets of the enterprise, ensuring confidentiality and compliance.

1. Manufacturing enterprises standardize and clean real-time sensor data on the production line through data governance. Accurate sensor data can more accurately reflect the operating status of equipment, reduce measurement errors, and improve the accuracy of production equipment failure prediction. Equipment adjustments or process improvements have been made to improve overall production efficiency.

2. Collect complete data from various business processes in supply chain management, and record the entire production batch data from raw material procurement to product delivery, enabling product quality tracking. Research and development, production, and sales data sharing and collaboration, breaking down data barriers between departments and improving internal management efficiency of the enterprise.

3. Data sharing and collaboration between upstream and downstream enterprises in the manufacturing industry are also very important. Enterprises can share relevant data with suppliers, distributors, etc., such as demand forecasting data, inventory data, etc., to achieve overall optimization of the industrial chain.

4. Data governance enables enterprise decision-makers to obtain accurate and comprehensive data support. Analyze production data, market data, etc., and explore potential market demands, product improvement directions, etc. When making strategic decisions, such as product research and

development, digital investment direction, market expansion strategy, etc., based on governance data, more scientific and reasonable decisions can be made.

5.The combination of NLP (Natural Language Processing) and knowledge graph with intelligent technology can improve data processing efficiency and explore the deep value behind data through advanced algorithms such as machine learning and natural language processing. Knowledge graph integrates dispersed knowledge from different departments, stimulates innovation in product design and development, and facilitates sharing and utilization by designers and engineers. The correlation analysis of these knowledge in the production process can timely identify factors that affect product quality. When there is an abnormality in the production process equipment, the knowledge graph can be used to quickly diagnose the cause of the fault.

In the face of the challenges faced by data governance in the digital transformation of the manufacturing industry, the following suggestions are proposed:

-With the surge in data volume, the issues of data security and privacy protection are becoming increasingly severe. By continuously iterating and upgrading security technologies such as encryption, data anonymization, and access control to address challenges, we have solved security vulnerabilities and provided a solid guarantee for data governance, meeting increasingly stringent data security regulations.

-Data analysis and data governance play a crucial role in promoting digital transformation of enterprises. Faced with the growing market demand and challenges of industry differentiation, enterprises need to continuously innovate and improve their data governance mechanisms by introducing intelligent solutions to fully tap into the potential value of data and lay a solid foundation for sustainable development.

-Enterprises can optimize their selection based on their own scale and needs, adopt open-source data governance tools, and combine cloud computing services to reduce technology costs.

-Enterprises cultivate their own team of data governance talents through internal training; And cooperate with universities and research institutions to introduce external talents, while reasonably planning the talent structure.

-The traditional management model in traditional manufacturing emphasizes hierarchical structure and departmental segmentation, which conflicts with the concepts of cross departmental collaboration and data sharing required by data governance. Organizational change requires the determination of senior management and the active participation of all employees to change traditional management models.

Conclusion

In the context of global digital transformation, data has become a key element of a company's core competitiveness. Data governance has multiple positive impacts on the digital transformation of China's manufacturing industry, ranging from improving data quality to promoting intelligent decision-making. However, during the implementation process, there are also challenges such as cost investment and resistance to organizational change. Therefore, by adopting corresponding response strategies such as cost control strategies and organizational change management strategies, manufacturing enterprises can better leverage the role of data governance, accelerate the process of digital transformation, and enhance their competitiveness in the global market. In the future development, with the continuous advancement of technology and the continuous innovation of management concepts, the importance of data governance in the digital transformation of China's manufacturing industry will be further highlighted.

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Исследование влияния управления данными на цифровую трансформацию обрабатывающей промышленности Китая

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Аннотация

С быстрым развитием информационных технологий китайская обрабатывающая промышленность находится в критическом периоде цифровой трансформации. Управление данными как эффективное средство управления активами данных, система знаний DAMA по управлению данными и китайский национальный стандарт DCMM имеют далеко идущие последствия для цифровой трансформации в обрабатывающей промышленности. В этой статье подробно анализируется положительное влияние управления данными на цифровую трансформацию обрабатывающей промышленности Китая с точки зрения повышения качества данных, обеспечения безопасности данных, оптимизации бизнес - процессов, содействия обмену данными и синергии, а также содействия интеллектуальному принятию

решений в системах управления данными и системах ценности данных. Обсуждается практика и применение управления данными и управления активами данных в обрабатывающей промышленности Китая с целью изучения влияния управления данными на обрабатывающую промышленность. В этой статье описывается мировая динамика в области управления данными, результаты исследования могут быть применены к цифровому преобразованию различных отраслей промышленности с опытом управления данными в Китае, и предлагаются соответствующие стратегии реагирования.

Для цитирования в научных исследованиях

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Ключевые слова

DAMA, Управление данными, цифровая трансформация, производство, управление активами данных, DCMM, искусственный интеллект, технологические инновации, безопасность данных.

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