

Enterprise Digital Planning and Architecture Based on Industrial Internet Platforms

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Abstract:

Under the current background of information society, the digital transformation of enterprises has become a necessary means to enhance the competitiveness of enterprises. This article is based on the industrial Internet platform, digital planning, and architecture of enterprise research. First, we analyze the current challenges of digital transformation and the development opportunities brought by the industrial Internet. Then, we propose a digital planning method based on the industrial Internet platform, which takes the full connectivity of humans, machines, and objects and intelligent decision-making as the core, takes data collection, processing, analysis, and application as the main line, and finally forms the top-level design of the digital transformation of enterprises. At the same time, we also build an industrial Internet platform architecture model, the four levels of the previous end perception layer, network transmission layer, platform service layer, and application innovation layer, to support enterprises in the innovative application and decision support under the industrial Internet environment. Research shows that this kind of enterprise digital planning and architecture based on industrial Internet platforms can effectively promote enterprises to achieve business model innovation and system innovation, and strengthen the flexibility and agility of enterprises to respond to market changes. The results of this research not only have important theoretical and practical significance for guiding enterprises to carry out digital planning and build industrial Internet platforms but also provide useful references for relevant policy formulation.

Keywords:

Industrial Internet platform
Enterprise digital planning
Architecture model
Innovative application
Agility

Online publication: December 27, 2024

1. Introduction

In today's information society, companies need to adapt to digital change. While this transformation is challenging, the use of industrial Internet platforms has brought new opportunities for enterprises. The paper first expounds on the challenges of digital transformation faced by enterprises and then analyzes the development opportunities brought by the industrial Internet platform for enterprises, such as deepening the application, promoting innovation, and strengthening decision-making. Then, the paper proposes an enterprise transformation method based on an industrial Internet platform and builds a model of an industrial Internet platform. Finally, the paper discusses how to successfully achieve this transition. This study aims to help enterprises in digital planning and improve their ability to respond to market changes. The results of this study are not only theoretically instructive, but also helpful for practical operation and provide a reference for relevant policy making.

2. Challenges of enterprise digital transformation and industrial Internet platform

2.1. Challenges of digital transformation in current enterprises

At present, digital transformation has become an important strategic direction for enterprises to adapt to the rapidly changing market environment^[1]. Despite the wide range of opportunities brought by digital transformation, enterprises face many challenges in the implementation process. Technological challenges are undoubtedly the most prominent part of the digital transformation process. Many enterprises lack corresponding technical reserves and specialized talent support when adopting new technologies, leading to often being in a passive position when choosing and implementing digital solutions. The compatibility of old and new systems also limits the effective realization of technology updates and integration, increasing the cost of digital transformation and technology complexity.

On the other hand, the transformation of corporate culture and organizational structure is also a major challenge in digital transformation. The decision-making

mechanism and management concepts of many traditional enterprises are deeply rooted, and inertia thinking and resistance to change often lead to the digital process^[2]. In some enterprises, digital transformation is too dependent on the commitment of the management, and there is a lack of full participation and understanding^[3]. This situation easily causes internal communication, resulting in the digital transformation measures cannot be implemented at the practical level. The organization is often not flexible enough to support the agility and quick response needed for digital transformation.

Data security and privacy issues are also important challenges in the digital transformation of enterprises. In the application process of an industrial Internet platform, a large number of enterprise data needs to be transferred and shared in different systems, which undoubtedly increases the risk of data leakage and improper use^[4]. At present, the increasingly stringent data protection laws and regulations around the world also require enterprises to strengthen the control and compliance management of data. Rapidly promoting digitalization to ensure data security and compliance is an urgent problem for enterprises to solve.

The uncertainty of the market environment and the intensification of the competition have also put forward higher requirements for digital transformation. Companies should not only transform technically and culturally but also have the ability to dynamically adjust their strategies to cope with the changing market demand and competitive situation. This requires enterprises to enhance their innovation ability, identify market opportunities in time, and respond quickly to changing needs^[5]. The contradiction between the speed of this environmental change and the speed of internal transformation makes it difficult for many enterprises to maintain a continuous competitive advantage.

The uncertainty of economic cost and return on investment is also one of the key challenges of the digital transformation of enterprises. Digital transformation requires enterprises to make a large amount of capital investment, including hardware facilities upgrading, software development, and talent training, but its return cycle is often long, and the exact return on investment is difficult to predict. This has greatly affected the investment decisions of enterprises in the process of

digital transformation, especially in small and medium-sized enterprises. The doubts of senior managers about the transformation investment may lead to insufficient support for the digital transformation, or overly conservative thinking, thus affecting the overall progress and effect of the transformation.

In the process of digital transformation, technology, culture, data security, market environment, and economic cost are interwoven and have far-reaching influences, which bring great complexity to the decision-making and implementation of enterprises. It is critical that companies develop effective digital transformation strategies based on the various challenges and their own actual conditions. This requires not only technological innovation, but also the transformation of organizational structure and culture to ensure the coherence and sustainability of digital strategies and achieve a true success of transformation.

2.2. Development opportunities brought by the industrial Internet

As the product of the deep integration of the new generation of information technology and the manufacturing industry, the industrial Internet provides important opportunities for the digital transformation of enterprises. By combining the Internet of Things, cloud computing, big data, artificial intelligence, and other technologies, it has built a brand-new, manufacturing-oriented Internet ecosystem. In this system, data becomes the core element driving enterprise innovation and development.

The primary opportunity brought by the industrial Internet is to improve production efficiency. By building a digital network covering the whole production process, enterprises can realize real-time interconnection between production equipment, production lines, workshops, and factories. The seamless connection and data sharing between devices enable enterprises to accurately monitor and regulate the production process in real time. This can not only effectively reduce the production loss caused by equipment failure, but also optimize the production scheduling and resource allocation through big data analysis, so as to significantly improve the production efficiency and reduce the operating costs.

The second important opportunity is to promote innovation in enterprise business models. Under

the ecology of the industrial Internet, traditional manufacturing enterprises can break through the past single-product sales mode, and gradually change to the “product + service” mode. Through the Internet of Things technology, enterprises can access customer use data and product performance data, thus providing personalized follow-up services, and realizing the upgrade from one-time sales to continuous services. Such a change can not only improve customer satisfaction but also increase the added value and profit margin of enterprises.

Industrial Internet also provides a new perspective and method for the supply chain management of enterprises. Through the widely used Internet of Things interconnection technology, enterprises can realize the overall control and optimal management of all links in the supply chain. This enables enterprises to flexibly adjust production plans and inventory strategies according to the changes in market demand, enhance the elasticity and response speed of the supply chain, reduce risk and cost, and improve market competitiveness.

In terms of quality management, the industrial Internet also provides unprecedented opportunities. By establishing a comprehensive quality monitoring system, enterprises can use big data analysis to conduct real-time monitoring and feedback on product quality. Predictive maintenance and optimization of the quality control strategy can significantly improve the quality of products and enhance the brand image and market reputation.

The industrial Internet has also greatly promoted cross-industry and cross-field collaborative innovation. Enterprises can break the boundaries between traditional industries, connect other enterprises, scientific research institutions, and service providers through data sharing and resource integration, and jointly develop and promote new technologies, products, and services. This collaborative innovation not only drives technological progress but also brings new market opportunities and commercial value.

As the key driving force for the upgrading of the modern manufacturing industry, the industrial Internet provides multiple development opportunities for enterprises in the digital transformation. By improving production efficiency, innovating business models, optimizing supply chain management, and realizing collaborative innovation, enterprises can better adapt to

market changes, enhance competitive advantages, and achieve sustainable development. In the face of these opportunities, enterprises should take active strategic measures to accelerate the deployment of industrial Internet and fully tap its potential value.

3. Enterprise digital planning based on the industrial Internet platform

3.1. Digital planning method combined with the full connectivity between man and machine

In the process of enterprise digital transformation, it is a vital link to realize the full connectivity of humans, machines, and objects. The core of the digital planning method lies in the organic combination of humans, machines, and objects through the industrial Internet platform to promote the efficient integration and coordinated operation of enterprise internal resources. The industrial Internet platform is not only a collection of technological innovations but also a bridge for enterprises to achieve full connectivity.

The full connectivity of humans, machines, and objects can break the barrier of information islands within traditional enterprises. In the traditional mode, each part of the enterprise often operates independently, and the poor flow of information leads to low communication efficiency and insufficient utilization of resources. Through the industrial Internet platform, enterprises can realize the real-time sharing and transparent management of various data, and ensure that the relevant information is timely and accurately conveyed to different decision-making levels and execution levels.

Humans, machines, and objects being fully connected can also significantly improve the intelligent decision-making ability of enterprises. When equipment and personnel can be interconnected, enterprises can collect information about equipment operation status, production schedule, and personnel operation in real time through sensors and edge computing technology. After effective integration and analysis, these data can provide insightful decision support for the enterprise executives, help enterprises quickly deal with problems in production, optimize the production process, and improve production efficiency.

In the process of realizing the full connectivity

between humans, machines, and objects, data security and privacy protection cannot be ignored. In this process, enterprises need to establish a sound data security mechanism to ensure that the data is not tampered with or leaked in the transmission process. Encryption technology and authority management systems can be used to protect important data assets and maintain the integrity and confidentiality of enterprise information.

Full human-machine and object connectivity need to adapt to the unique application scenarios and needs of enterprises, which requires fully considering the actual needs of different departments of the enterprise for digital transformation in the planning to realize personalized solutions. This personalized scheme can be realized by flexibly allocating various technology modules of the industrial Internet platform, so as to meet the specific requirements of different industries and enterprises in the process of digital transformation.

The process of enterprise digital planning based on an industrial Internet platform, combined with the method of fully connected human-machine-object can not only improve the information transmission and processing capacity of enterprises, but also support the construction of intelligent factories and the future development of intelligent manufacturing, which makes it possible for enterprises to create new competitive advantages in the era of digital economy. By integrating resources, improving efficiency, and ensuring data security, enterprises will gain the initiative in the rapidly changing market environment and achieve sustainable development.

3.2. Digital planning main line based on data acquisition, processing, analysis, and application

In enterprise digital planning, data collection, processing, analysis, and application constitute a complete main line, which is the core link of realizing the digital transformation. Data collection is the starting point of digital planning. It obtains real-time data of enterprises in production, sales, logistics, and other links through sensors, Internet of Things devices, and other ways. This step ensures that companies can obtain real, effective information from a wide range of sources, laying the foundation for subsequent processing and analysis.

Data processing plays a key role in the transformation of the collected raw data into useful information. Through data cleaning, classification, and storage steps, we can eliminate the noise in the data and improve the quality and reliability. With the support of the industrial Internet platform, enterprises can quickly carry out efficient and low-cost processing of huge data, which provides a solid foundation for data analysis.

Data analysis is the use of intelligent algorithms and analysis tools to mine valuable insights from the processed data. Analysis can be subdivided into descriptive, diagnostic, predictive, and normative analysis. These analyses can reveal potential problems in business operations, predict market trends, and provide strong support for management's decisions.

Data application is the ultimate goal of digital planning, which transforms the processed and analyzed data results into practical actions of the enterprise. By integrating the analysis results into the decision process, enterprises can optimize the production process, improve product quality, and enhance customer satisfaction. Based on real-time data feedback, enterprises can respond quickly, accelerate the pace of innovation, and maintain market competitiveness.

The main line of digital planning based on data collection, processing, analysis, and application is the central axis running through the digital transformation of enterprises, so that enterprises can move forward steadily in the wave of industrial Internet. The proper application of this main line not only improves the operational efficiency and productivity of enterprises, but also provides a solid data foundation for the realization of long-term strategic goals.

3.3. Top-level design concept of enterprise digital planning

The top-level design concept of enterprise digital planning is the basis for promoting enterprises to realize digital transformation in the complex and changeable market environment. The design concept is supported by the industrial Internet platform and aims to guide enterprises to effectively coordinate various resources in the process of digitalization through structural solutions. The core of the top-level design lies in the seamless connection of humans, machines, and objects and the

realization of intelligent decision-making. By building a comprehensive, flexible, and efficient digital platform, the business process, management process, and innovation mode of the enterprise can be optimized.

The top-level design of digital emphasizes the construction of the global architecture, which needs to determine the strategic goals from the long-term development of the enterprise and the actual needs of the present, and effectively connect with all levels and modules within the enterprise. This is to ensure that the full life cycle management of data is an important part of the digital top-level design of an enterprise. Through the collection, processing, analysis, and application of data, the efficient operation of information flow can be realized to provide strong support for enterprise decision-making. Emphasis should be placed on the standardization and modular design of the information and technology architecture to enhance the scalability and interoperability of systems and support future technology upgrades and business expansion.

The digital top-level design also needs to consider the "soft" factors such as corporate culture, organizational structure, and personnel ability. The introduction of a change management mechanism aims to promote the cultivation and implementation of digital awareness in the enterprise, so that employees can adapt to and promote the digital transformation of the enterprise. The top-level design should also focus on the market and customer needs to ensure that the products and services provided by enterprises are more competitive in the digital environment. Through integrated design, the digital transformation of enterprises can be promoted in all aspects, so that they can better adapt to market changes and improve their innovation ability and market response speed.

4. Conclusion

Based on the industrial Internet platform, this research studied the digital planning and architecture of enterprises, solved the challenges of digital transformation faced by enterprises under the current social background, and made full use of the development opportunities brought by the industrial Internet. We proposed the enterprise digital top-level design based on the industrial Internet

platform and constructed the architecture model of the industrial Internet platform, which provides support for the innovative application and decision-making of enterprises in the industrial Internet environment. The research results show that this method can effectively promote enterprises to achieve business model and system innovation, enhance the flexibility and agility of enterprises in the face of market changes, and show great practical application value. Meanwhile, there are some limitations in this study. For example, for the specific industrial Internet platform application scenarios and enterprise characteristics, carrying out a more detailed and specific enterprise digital planning and architecture

design still needs further research. In addition, quantifying and evaluating the impact of industrial Internet platforms on the effect of digital transformation of enterprises is also an important direction of future research. In general, this research puts forward new insights and strategies for enterprise digital planning under the industrial Internet platform from the perspectives of theory and practice. We expect that this study can provide certain academic support for the digital transformation of enterprises, provide useful references for relevant policy formulation, and further promote the digital process of Chinese enterprises.

Disclosure statement

The authors declare no conflict of interest.

References

- [1] Lin F, 2021, Promoting the Digital Transformation of Micro, Small and Medium-Sized Enterprises Through the Industrial Internet Platform. *Research on Industrial Innovation*, (17): 26–28.
- [2] Zhang X, Zhou Y, Xu S, et al., 2021, Industrial Internet Platform Application Evaluation Helps Enterprise Digital Transformation Research. *China Management Informatization*, 24(23): 89–91.
- [3] Wang J, Ma L, 2020, Industrial Internet Innovation Boosts the Digital Transformation of Enterprises. *Shanghai Quality*, (10): 26–29.
- [4] Deng S, Yang T, Zhang C, et al., 2020, Enterprise Digital Planning and Architecture Based on Industrial Internet Platform. *New Technology and New Process*, (10): 5–8.
- [5] Zhao J, Gao M, Liang N, 2022, The Industrial Internet Boosts the Digital Transformation of Manufacturing Enterprises. *China Automatic Identification Technology*, (01): 58–60.

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