Exploration and Analysis of Digital Transformation Path of Power Grid Enterprises Based on Internet of Things

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Abstract: In order to understand the digital transformation path of power grid enterprises, a research on the exploration and analysis of digital transformation path of power grid enterprises based on the Internet of Things is put forward. Firstly, this paper analyzes the problems encountered in the digital transformation of power enterprises. Secondly, in order to realize the digital transformation of power grid enterprises, it puts forward specific implementation strategies and points out the problems in the transformation process. Finally, the security system of digital transformation of electric power enterprises is analyzed, and the transformation path of "informatization, networking and intelligence", the operation mode of "physical asset-driven, technical service-driven and data asset-driven" and the security system of "safety, system, talents and culture" are systematically and innovatively put forward. As the world enters the era of digital economy, digitalization has become a new kinetic energy engine for the transformation and development of China's power enterprises.

Keywords: Internet of Things; Power grid enterprises; Digital transformation

1 INTRODUCTION

With the continuous development of society, digitalization has become the driving force of social development and enterprise innovation under the Internet of Things. Power grid enterprises should keep up with the development trend of the Internet of Things, implement the big data strategy and realize the construction of digital power grid. Based on the actual development of digital transformation of power grid enterprises, it is of great significance for power grid enterprises to study the implementation strategy of digital transformation in combination with specific problems. In the modern society with the rapid development of "Internet of Things+",5G and big data, the digital transformation of power grid enterprises is inevitable. Based on cloud computing and big data, promoting the deep integration of digital technology and power grid provides soil for the future development direction of power grid enterprises. The digital transformation of power grid enterprises needs to combine the current technological development conditions, actively plan the development strategy deployment, and constantly try to innovate and develop. Under the background of "Internet of Things+"and

ICIDC 2023, June 02-04, Nanchang, People's Republic of China

DOI 10.4108/eai.2-6-2023.2334627

big data, power grid enterprises can try to establish a digital intelligent distribution network planning auxiliary system, develop big data applications, build smart grids through big data technology, and accelerate the digital transformation and development of power grid enterprises[1]. As shown in Figure 1:

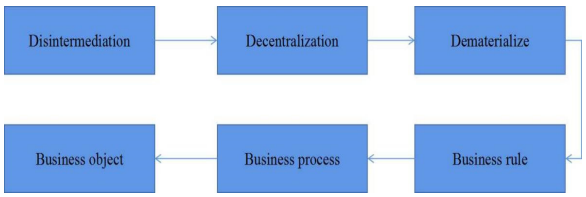

Figure 1: Digital Transformation Path of Power Grid Enterprises

2 POWER GRID ENTERPRISES IN THE DIGITAL TRANSFORMATION PROBLEMS ENCOUNTERED

2.1 Enterprise employees do not know enough about advanced technology

Because the concept of big data is an advanced technical means that has emerged in recent decades, power enterprises, as an important part of national social stability for many years, have still gone through many detours in the process of digital transformation. For example, although power grid enterprises have introduced ERP and 0ACRM software to handle related businesses of enterprises and complete various processes online, in fact, these program processes are fixed. Sometimes the managers of an enterprise decide to use a certain software for their business work, and the initial ideal is very good. However, in the actual use process, because these softwares require certain technology, the original employees may be reluctant to try new things because of their old qualifications, and would rather spend their efforts to complete the work offline than learn the use of new software. This makes these softwares have been developed, but they haven't got a platform to use, and the internal work of enterprises still follows the traditional model.

2.2 The foundation of digital technology is weak

Digital transformation is beneficial to information system construction and data collection. In recent years, power grid enterprises have accumulated a lot of data with the development of digital, which has made sufficient preparations for digital transformation. However, the digital transformation of power grid enterprises is mainly carried out from the perspective of departments. Information systems mainly record the data content needed by business departments or other departments, but do not integrate future analysis applications and cross-business content, resulting in inconsistent data standards among systems and data loss. Due to the internal and external requirements of network security management and control, the promotion of new technologies and methods has hindered the further implementation of digital transformation. In addition, in terms of data management, the operation department has not managed all the data from creation to use, and the overall data content is still in the primary stage, resulting in inconsistent data standards, high repetition rate of equipment coding, and a gap with the actual situation. Secondly, because the ability of automatic

collection is relatively backward, except for real-time data collection in marketing business, other data are mainly input manually, which also greatly reduces work efficiency[2-3].

2.3 Big data applications are not ideal

By using advanced information technologies such as artificial intelligence, cloud computing and big data, the collected massive data are analyzed and sorted out, and the laws contained therein are found, and then valuable data information is selected as an important basis for enterprise decision-making, through effective management and innovation of big data, scientific decision-making based on digitalization is realized.It is the goal of digital transformation. In recent years, although power grid enterprises have invested a lot of energy in the research of big data, they have also tried different digital transformation paths through specific practices. However, as far as the whole industry is concerned, the digital transformation of power grid enterprises is still in the initial stage of exploration, and there are still shortcomings in the application of big data P1: ① The situation of big data application is not ideal, and there is a lack of overall management; ② The application result is mainly to improve the professional internal management level of enterprises, and there are relatively few interdisciplinary big data applications and supporting enterprise decision-making, and the overall development of enterprises and external services lack big data applications; ③ The depth of data analysis and mining is not enough. Compared with other industries, the comparison list of big data mining types of current power grid enterprises-. Data mining methods are mainly simple data statistics, lacking in-depth research on advanced big data applications, while big data applications are only used to study simple statistics; ④ The application mechanism of data mining results is not perfect, and there are problems in paying attention to data analysis and ignoring the application of results, which leads to the final calculation results not being popularized and the role and value of big data not being effectively utilized[4-5].

3 THE SPECIFIC IMPLEMENTATION STRATEGY OF DIGITAL TRANSFORMATION OF POWER GRID ENTERPRISES BASED ON THE INTERNET OF THINGS

3.1 Improve data acquisition capabilities

Digital transformation needs to rely on a sound digital infrastructure, and it needs to increase investment in infrastructure construction and popularize it throughout the country, so as to effectively improve data acquisition capabilities. When collecting user current data, the data collected from the upper voltage side should be extended to the low voltage side, and the power grid automation data should be extended from the main network to the distribution network; The monitoring system should be used to collect the operation data of the equipment as the maintenance data of the equipment state, so as to improve the scope and quality of the collected data. In order to realize the digital transformation of power grid enterprises, it is necessary to improve the breadth and depth of data collection in order to lay the foundation for the transformation. As shown in Table 1:

3.2 Expand business contacts between enterprises

Starting from the overseas cooperation cases of financial and insurance companies, power companies can accurately outline the needs of users according to the existing data results, provide comprehensive services for digital transformation, expand the business scope of power grids, realize multi-energy supply, provide services such as energy for electric vehicles, and create an ecological service circle based on big data.

(1) To carry out energy-saving monitoring and household electricity safety monitoring, and to provide electricity service for the elderly living alone, charging service for residential users and other business scenarios; (2) Implement specific scenario design for industrial users, and solve problems in practical applications, such as energy consumption monitoring, environmental protection monitoring, fault diagnosis and agency operation and maintenance services; (3) To assist in the development of urban construction investment, optimize the industrial layout of government units, and provide auxiliary reports for superior leadership departments.

3.3 Improve the construction of enterprise management system

In order to truly implement digital transformation, in the process of big data conversion, power enterprises need to build a perfect digital management mechanism. ① Establish a digital management department. Build a professional digital management team, set up professional digital management personnel, establish a data research and development center, and introduce corresponding management systems. On the basis of a sound organizational structure, specialized agencies and staff will deal with important issues of digital transformation, and clarify their own work contents and obligations; ② Power enterprises must strive to create a working atmosphere conducive to digital transformation. In the process of digital transformation, it is necessary to constantly sum up past experience, strengthen the research and application of big data applications on the original basis, and form a complete theoretical and practical system. To this end, enterprises can hold a knowledge contest about digitalization, encourage employees to keep learning advanced technologies, so that employees can continuously improve their cognitive level, and incorporate digital transformation into corporate culture content, so that employees can better understand big data content. The most important thing is to strengthen personnel training and organizational construction. If power enterprises want to realize digital transformation, they must introduce compound talents with big data technology and power knowledge, master the knowledge and skills of digital transformation, and have excellent management ability and advanced technical means. Electric power enterprises can reach cooperation with local colleges and universities to attract outstanding talents by providing practical platforms and employment platforms for college students. In addition, it is necessary to update the talent training and utilization mechanism within the enterprise, provide an upward path for talent development, improve the competency-based and performance-based salary system, encourage employees to continuously learn and expand their comprehensive strength, improve the education and training mechanism, and promote the development of talents[6].

Table 1: Implementation Strategies of Digital Transformation

Digital benefit		Strategic digitalization	
Innovation benefit	social benefit	Strategic formulation	Talent incentive
Data storage	Data application	Scene service	Developing ability
Cloud on device	Digitization of resources	Data management	Factor dataization

4 MODE PATH OF DIGITAL TRANSFORMATION OF ELECTRIC POWER ENTERPRISES

The general idea of digital transformation of electric power enterprises is "three modes and three steps" (three modes: physical assets-driven, technical services-driven and data assets-driven, three steps: informationization, networking and intelligence), to digitally reshape the core business scene of enterprises, promote organizational changes and process reengineering that adapt to digital development, and drive the transformation and upgrading of enterprises to serve the high-level development of digital economy. As shown in Table 2:

(A) the scientific choice of digital transformation business model

1. Accurately grasping the business model type of digital transformation and accurately grasping the essential connotation of the business model of digital transformation is the basis and premise for accurately selecting the business model type. The practice of successful enterprises in digital transformation proves that there are three types of enterprise operation modes: physical asset-driven, technical service-driven and data asset-driven. In essence, the digital transformation mode is an operation mode. Power enterprises first change from "physical asset-driven" to "technical service-driven", and then from "technical service-driven" to "data asset-driven", so as to build an open, shared, mutually beneficial and win-win industrial ecology and realize full sharing of power data, full agility of network information and full connection of intelligent terminals.

2. Digital transformation must go through "technical service-driven" and it is very difficult to change from physical asset-driven to technical service-driven. For example, IBM Company in the United States has successfully transformed from an information product supplier to an information technology service provider after ten years of hardships. "Data Asset-driven" is an upgraded version of "Technology Service-driven". It is difficult to succeed if you go through the "Technology Service-driven Transformation" and directly enter the "Data Asset-driven" enterprise. Because of the thinking inertia of "attaching importance to physical assets", it is difficult for electric power enterprises to change from "physical assets-driven" enterprises to "technical services-driven" enterprises without building a complete set of organization, process, technology, service and cultural system centered on customers. Therefore, it is necessary to build enterprise goals around customer value and promote the transformation from "physical asset-driven" to "technical service-driven"[7-8].

(B) choose the correct path of enterprise digital transformation

Digital transformation is a process of development towards networking and intelligent innovation on the basis of informationization. Adhere to strategic guidance, accelerate the integration of digital technology and power enterprises, promote enterprise informationization,

networking and intelligence, and better adapt to the development of the times, customer needs and market competition.

Connecting the whole process and implementing business process informatization is the primary stage of digitalization, and digital transformation enterprises must go through this stage of informatization construction. Informatization is mainly the application of a single department, and there is little cross-departmental, cross-business and cross-industry integration, which reflects a management thinking, and its value is mainly reflected in the improvement of enterprise management quality and efficiency. In the era of digital economy, the information system and information technology service means of power enterprises can not meet the needs of digital transformation. The purpose of digitalization is to create customer value, the core is the communication and interaction between internal links of enterprises and between enterprises and upstream and downstream, and the key is the high integration of digital technology with business, management and service. For electric power enterprises, it is essential to adopt digital technology to support the management decision-making, production and marketing, customer service and the integration of production, supply and demand chains under the circumstances of huge organization scale, complex business system, long management chain and numerous customer groups. Therefore, first, carry out the pre-evaluation of digital transformation. Before the start of digital transformation, we should sort out the actual situation of business operation, personnel organization and business process, evaluate the existing digital transformation foundation, establish the demand of digital transformation, clarify the business logic of enterprises and determine the direction of digital transformation. Second, strengthen the top-level design of digital transformation. On the basis of finding out the family background, we should plan the digital transformation as a whole, carry out the digital top-level design, identify the breakthrough point of digital transformation, and clarify the strategic goal and practical path of transformation. Third, reshape the new form of power enterprises. According to the digital transformation idea of "top-level design, data integration, digital empowerment and ecological landing", a new "flat, collaborative and automatic" mesh node organizational structure is established, a new "differentiated, scene-based and intelligent" management model is constructed, and a "customer-centered" active, intelligent, accurate and high-quality customer service model and "decentralized and disintermediated" are created. Fourth, through the upstream and downstream processes of the industrial chain. Internally, it is necessary to connect the breakpoints of business, management and service under the traditional management mode, run through the business, management and service processes, and realize the informationization of business, management and service. At the same time, it is necessary to connect the upstream and downstream of the industrial chain, open up the production chain, supply chain and demand chain, and realize the informationization of the industrial chain. Fifth, promote the digitalization of the upstream and downstream of the industrial chain. Promote the digitalization of information carriers and communication modes, and realize the digitalization of information, knowledge and transmission modes. Accelerate the digital transformation of power enterprises, promote the digital process of the upstream and downstream of the industrial chain, build a digital ecosystem, and realize the power equipment, products, services and Digitization of industrial upstream and downstream chains.

Table 2: Mode Path of Digital Transformation

operating decision	Investment management	Mayor management	risk management	performance management
Production operation	Planning business	Electric power construction business	Electric power safety business	Diversified modular business
Comprehensive support	management of talented people	Treasury management	materials management	Integrated management service

4.1 Improve the security system for digital transformation of power enterprises

Digital transformation of electric power enterprises is a complex systematic project, which requires not only scientific selection of practice path and business model, but also improvement of the "security, system, talents and culture" guarantee system for digital transformation of enterprises.

(A)Improve the data security system

With the new infrastructure further promoting the integration of the digital world and the physical world, data security risks have expanded from the digital world to all application scenarios in the physical world. Power data involves business secrets and personal privacy. Therefore, it is necessary to strengthen the security bottom line thinking, build a large security protection system covering network security, data security, information security and key infrastructure security, enhance the depth security defense capability, build a three-dimensional security supervision network, protect business secrets of enterprises and personal privacy of customers, prevent the disclosure of sensitive data and personal information, and realize zero invasion of network boundaries.

(B)Improve the digital economy policy system

Digital economy policy system is the key and guarantee of enterprise digital transformation, which provides value guidance and behavior norms for enterprise digital transformation. To this end, it is necessary to build a digital economic policy system for digital transformation, speed up legislation in the field of digital economy, establish data confirmation, opening, circulation and trading mechanisms, improve data property rights protection and data security protection systems, build a data equity incentive system, safeguard the data sovereignty of enterprises and individuals, guide the orderly flow of data, improve the efficiency of data transactions, and empower the digital transformation of value-assigned enterprises.

(C)Improve the digital enterprise culture security system

The digital transformation process of electric power enterprises is also the process of reshaping corporate culture. In the process of digital transformation, the change of corporate culture is the biggest challenge for enterprises. Therefore, we should adhere to the problem-oriented and goal-oriented, create a digital thinking of "efficiency first, continuous iteration and sharing of things", and cultivate the decision-makers, managers and employees of enterprises. Digitalization ability reshapes the digital cultural environment of "customer-oriented, demand-oriented, co-construction and sharing", encourages them to boldly explore, iteratively improve and innovate in practice, so that enterprises can fundamentally realize

digital transformation, continuously release the great energy of digital productivity, and create greater civil value, political value and social value[9-10].

5 CONCLUSIONS

In a word, digital transformation is an important direction of enterprise development strategy and an important means to realize enterprise innovation and development and consolidate digital transformation. Managers of electric power enterprises need to sum up past experiences and lessons, transform traditional enterprises into digital enterprises, and become digital transformation enterprises with rapid, sustainable and healthy development in the process of digitalization.

REFERENCES

[1]Chang, V. , Ramachandran, M. , & Li, C. S. . (2022). Special issue editorial on emerging trends in internet of things for e-health and medical supply chain systems. Expert systems: The international journal of knowledge engineering14(4), 39.

[2]Dolfsma, W. , Mahdad, M. , Hasanov, M. , & Isakhanyan, G. . (2022). A smart web of firms, farms and internet of things (iot): enabling?collaboration-based business models in the agri-food industry. British Food Journal, 124(6), 1857-1874.

[3]Gao, Y. , Yu, F. , Zhang, H. , Shi, Y. , & Xia, Y. . (2022). Optimal downlink power allocation schemes for ofdm-noma-based internet of things:. International Journal of Distributed Sensor Networks, 18(1), 6100-6115.

[4]Egwuonwu, A. , Mordi, C. , Egwuonwu, A. , & Uadiale, O. . (2022). The influence of blockchains and internet of things on global value chain. Strategic change: An international journal of management theory and practice12(1), 31.

[5]Zhang, H. , Uddin, M. , Hao, F. , Mukherjee, S. , & Mohapatra, P. . (2022). Maide: augmented reality (ar)-facilitated mobile system for onboarding of internet of things (iot) devices at ease. ACM Transactions on Internet of Things14(2), 3.

[6]Dami, S. . (2022). Internet of things-based health monitoring system for early detection of cardiovascular events during covid-19 pandemic. World journal of clinical cases, 10(26), 9207-9218.

[7]Rebelo, R. , Pereira, S. , & Queiroz, M. M. . (2022). The interplay between the internet of things and supply chain management: challenges and opportunities based on a systematic literature review. Benchmarking: An International Journal, 29(2), 683-711.

[8]Lodhi, M. A. , Wang, L. , & Farhad, A. . (2022). Nd-adr: nondestructive adaptive data rate for lorawan internet of things. International journal of communication systems(9), 35.

[9]Xu, W. , Zhang, J. , Huang, S. , Luo, C. , & Li, W. . (2022). Key generation for internet of things: a contemporary survey. ACM computing surveys(1), 54.

[10]Wang, Y. , Che, T. , Zhao, X. , Zhou, T. , Zhang, K. , & Hu, X. . (2022). A blockchain-based privacy information security sharing scheme in industrial internet of things. Sensors (Basel, Switzerland), 22(9)45.