The Exploration and Application Research of Emerging Technologies in Material Management Business of Large Power Grid Enterprises

Yong Zhang¹, Jin Liu² and Hao Shang³

¹State Grid Energy Research Institute Co, Ltd, Beijing, 102209, P.R China;
²State Grid Energy Research Institute Co, Ltd, Beijing, 102209, P.R China;
³State Grid Corporation of China, Beijing, 100031, P.R China;

Abstract: The new round of information technology revolution represented by big data, cloud computing, internet of things, artificial intelligence and mobile internet has created conditions for the application of operation and maintenance services in power grid enterprises. This paper analyzes the opportunities and challenges of the application of emerging technologies. This paper further explores the problems existing in the application of emerging technologies in the material management business, such as untimely information acquisition, low data quality, low intelligence level of screening and evaluation, etc., and puts forward the key points and directions of the application of emerging technologies in the material management business of power grid enterprises.

1. Introduction

Firstly, the state vigorously promotes the development of emerging industries and creates a good external environment for the application of emerging technologies by power grid enterprises. The 19th National Congress of the Communist Party of China proposed to build a network power, a digital China and a smart society. Promote the deep integration of Internet, big data, artificial intelligence and real economy; developing digital economy, sharing economy and cultivating new momentum. General Secretary Xi Jinping put forward such important ideas as "Internet represents new productivity and new development direction". In terms of macro policies, governments at all levels vigorously promote the development of emerging industries. Since 2015, the State Council has successively issued documents such as "Guiding Opinions on Actively Promoting the" internet plus "Action", "Several Opinions on Strengthening the Service and Supervision of Market Subjects with Big Data", "Action Plan for Promoting the Development of Big Data" and "National Information Development Strategy Plan". Local governments such as Shanghai and Chongqing have successively issued relevant documents. These policy documents provide policy support for enterprises to push forward the application of emerging technologies from the aspects of big clouds and things shifting wisdom.

Secondly, the new information technology revolution has created technical conditions for the application of emerging technologies. At present, the new round of information technology revolution represented by the shift of wisdom from big clouds to things accelerates social and industrial changes. Global informatization has entered a new stage of full penetration, cross-border integration, accelerated innovation and led development. Emerging Internet enterprises have made use of new technologies such as big data and cloud computing in the tertiary industries such as commerce, finance, transportation and catering, which have had disruptive effects. Emerging technologies have become the core driving force
for the upgrading of traditional industries and the development of emerging industries as well as the leading force for value reconstruction. Power grid enterprises must actively grasp and lead the new trend of the new round of information technology revolution, seize new opportunities, occupy the commanding heights, give full play to the role of information-driven guidance and value creation, and inject new impetus into the production, operation and innovation development of power grid enterprises.

2. Analysis of Challenges in Applying Emerging Technologies
Firstly, technological progress will lead to structural adjustment of human resources in power grid enterprises, requiring power grid enterprises to increase the transfer and training of tellers to enhance the value creation ability of employees. Technological progress will lead to the transfer of a large number of marketing tellers. Taking the banking industry as an example, the Internet transformation of bank outlets and businesses has promoted the transformation of employees. In this process, there is a lot of room for counter personnel to change jobs and become marketing personnel. ICBC reduced counter staff by 14,000 through the restructuring of its human resources in 2016, of which about 3,000 were engaged in emerging businesses and 11,000 were employed as customer managers. The bank's human resources efficiency was better improved through the restructuring and allocation of the bank. ICBC's total number of employees decreased by only 1% in 2017, but the internal structure adjustment reached 6%. In the future, with technological progress and changes in customer demand, there is still room for reduction of counter business in China's banking industry. It is similar to the banking industry. At present, the tellers in the business hall and power supply office of power grid enterprises account for a large proportion. The opening of electricity payment functions such as Alipay and WeChat will have a great impact on the existing business hall staff of power grid enterprises. This requires power grid enterprises to continuously streamline the number of business outlets and staff, increase the training and job transfer of tellers, and urge tellers to transform from waiting for customers to come to their homes to actively tap customers, further improve the efficiency of human resources and better adapt to market competition.

Secondly, technological progress has raised information and network security to a strategic level, resulting in increasingly complex and severe cyber space security situation. The 19th National Congress of the Communist Party of China stressed the need to adhere to the concept of national security and to coordinate traditional and non-traditional security. General Secretary Xi Jinping pointed out during the second collective study of the Political Bureau of the CPC Central Committee: “We should strengthen the security protection of key information infrastructure and strengthen the protection capability of national key data resources”. At present, the struggle over the control of cyberspace and the right to speak is becoming increasingly fierce. The network attacks on Ukraine's power plants and Iran's nuclear power plants as well as the “Bitcoin Blackmail Virus” and other incidents show that the security threats and attacks against the power information infrastructure in various countries in the world are increasing. Using the network to attack the power monitoring system and destroy the power grid security has become a real threat that cannot be ignored.

3. Current Situation and Problems of Application of Emerging Technologies in Material Business
Firstly, material management faces problems such as untimely information acquisition, low data quality and low intelligence level of screening and evaluation in procurement, supply and quality control. In terms of procurement, the key technical parameters of life cycle quality (test value, sampling value, operation value, etc.) are scattered, and the degree of automatic acquisition is poor, thus providing weak intellectual support for the formulation of procurement standards and selection of high-quality equipment. The structural ratio of the content data of electronic bidding documents is not high, the bid evaluation work still relies on manual verification and evaluation by experts to a large extent, the ratio of automatic screening and comparison bid evaluation factors is not large, and the intelligence level is not enough. On the supply side, the inventory information of the whole supply chain (supplier) cannot be controlled in real time, and the resource allocation ability is limited. There is a lack of linkage between information such as supply plan, production and supply cycle, and actual progress of the project, and the degree of automatic prediction and early warning and intelligent dynamic deployment is relatively
low. The Internet of Things technology is not widely used in production and manufacturing, transportation and distribution, on-site delivery and other links, and its online visualization degree and traceability ability are not enough. For example, the current scope of material allocation is limited to the inside of power grid enterprises, which is not connected to the supplier information system and cannot master the inventory information of the whole supply chain. There are limitations in the information of material allocable resources. In terms of quality control, a large number of data generated by quality inspection have not been collected and aggregated, and they have not given full play to their due value. They lack precise guidance on the objects and contents of quality supervision (suppliers, product categories, testing items, etc.). The quality information of each link in the whole life cycle is scattered and the degree of automatic collection is poor, which has not fully played a role in improving the quality of purchased equipment. The supplier's qualification performance and performance evaluation lack the ability to intelligently analyze the full amount of data, and the ability to scientifically formulate classification standards and evaluation index systems is insufficient.

Secondly, the material management of power grid enterprises has yet to make full use of technical means to realize the information sharing between internal departments and the linkage mechanism of efficient coordination with upstream and downstream supply chain enterprises. From an internal point of view, the concept of life cycle management has not yet been fully implemented. The data structure of development, construction, operation, marketing and other specialties is not balanced with that of materials specialties. The integration of the whole quantity is insufficient and the sharing of internal cross-specialty information is insufficient, which affects the collaborative development of businesses.

From the outside, the synergy of the construction of the external ecosystem is not strong, and the information integration has not fully covered the upstream and downstream enterprises of the supply chain such as suppliers, design units and third-party logistics, which restricts the power grid enterprises from playing a leading role in the supply chain ecosystem of the energy industry.

Thirdly, the existing material resources intensive platform has played a greater role in the supply chain management and control of power grid enterprises, but it has not been deeply integrated with modern information technologies such as "big cloud and moving intelligence", and intelligent decision-making has not yet been realized. In terms of data foundation, the existing material assistant decision-making system has only completed the data gathering of material specialty, but the data gathering and integration with other specialties has not been completed, lacking the foundation of big data analysis application. In terms of analysis and application, the ability to assist in decision-making is only limited to primary analysis and application of data such as index statistics and peer benchmarking. It has yet to carry out advanced application of cross-disciplinary big data and artificial intelligence technology from the overall perspective of power grid enterprises. It lacks support for asset life cycle management, integration of industry and finance, customer service, etc. and lacks integrated, high-level and forward-looking intelligent decision-making.

4. The focus and direction of emerging technology in the application of materials business

On the basis of the established material intensive management system (ECP2.0+ERP materials), modern information technologies such as big cloud and intelligence transfer are introduced to systematically, comprehensively and deeply carry out research and development and application of business data, data structure, Internet and business linkage modeling.

The first is to use big data technology to realize intelligent analysis and decision-making. With forecasting function, it can forecast the purchase demand and supply capacity, time and capital cost. Using project reserve plan, investment plan and other information, a demand forecast model is built to accurately forecast the annual purchase scale and scientifically and reasonably arrange batches. According to the milestone plan and other project progress information, referring to the material procurement and supply cycle, the project demand department will be automatically reminded to submit the demand plan in a timely manner. Accurate control of capital cost, reasonable arrangement and timely adjustment of budget, to ensure the smooth development of material demand declaration and purchase order creation, to meet the requirements of the construction schedule. It has analysis and evaluation
functions, including procurement concentration, material supply efficiency, product quality stability, etc. Accurate matching of the supply and demand plan, combined with the construction progress of the project and the supplier's production and stock situation, rolling preparation of the supply plan, to ensure the efficiency of the supply of engineering materials. Identify the key technical parameters that affect the quality of the whole life cycle of the equipment, record and collect structured data, and automatically judge the stability and consistency abnormalities of the technical parameters. It has strategy management functions, including procurement bidding strategy, material allocation strategy, quality inspection differentiation strategy, etc. Analyze the quotation rules for key materials, summarize the bidding quotation rules for key materials, and optimize the price scoring method. Promote the connection between supplier information systems and power grid enterprise systems, reduce information asymmetry, and enhance the ability of power grid enterprises to allocate logistics resources globally both inside and outside. Analyze the full amount of supplier qualification performance data, support the accumulation of supplier holographic image data, and implement differentiated quality inspection for suppliers with different performance. It has auxiliary decision-making functions, including hierarchical and classified management, precise investment management, and combination of production and finance services. Collect the full amount of data information such as social credit, qualification performance, performance evaluation and equipment operation status of suppliers, and establish a comprehensive supplier evaluation system and classification management system with internal and external information linkage. According to the material price information, the feasibility study estimate and project budget shall be accurately prepared to promote accurate investment. Innovating the service mode of combining production with finance to provide all-round and multi-level financial services to suppliers in the energy industry supply chain.

The second is to realize supply chain data sharing based on the national network cloud technology. To realize the data connection between each specialty, horizontal and professional departments within the materials. Change the independent deployment mode of ECP1.0, adopt advanced technologies such as micro-service, automatic operation and maintenance, and carry out the construction of a new generation of e-commerce platform (ECP2.0), switch the "small pool" of existing material system resources to the "large pool" of "national network cloud", effectively integrate with various systems, improve the robustness and reliability of material information system, and ensure users to use more smoothly. Realize the upstream and downstream data connection of production progress, manufacturer's inventory, third party logistics information, etc. Actively push information such as project progress, arrival demand, goods storage, payment and settlement to improve the service experience of suppliers. Access supplier production, inventory and other related data, accurately grasp the supplier's performance ability, reduce supply risks. Work with third-party logistics enterprises to study and formulate logistics data coordination standards, apply Internet of Things technology to control equipment logistics status in real time, and realize digital logistics. To realize the connection with external qualifications, credit evaluation, raw material prices, futures markets and other social platforms. Connect with the social credit system, automatically obtain the credit information of the supplier enterprise, and comprehensively evaluate the supplier's technology and performance ability; Share information on suppliers' bad behavior with social platforms, promote the survival of the fittest and purify the market. Access the data from the public platform of raw materials, establish a price change correlation model between major equipment and materials and raw materials, improve the price linkage mechanism, and jointly deal with price fluctuation risks; Release price information on equipment procurement to the outside world, guide the formation of a win-win price system for cooperation, and foster a healthy market competition environment.

Third, the Internet of Things technology is adopted to realize dynamic and automatic information collection. The physical ID management technology is adopted to realize quick identification of identities and aggregation of life cycle information. Using the physical ID of power grid assets, various professional systems of power grid enterprises can be opened up to realize the related sharing and online visualization of material information and data of engineering construction, production and operation, and to serve the power grid construction and operation and maintenance. RFID technology is adopted
to realize wireless identification and automatic operation of storage and quality inspection management. By scanning RFID tags instead of manual collection and delivery, the efficiency of goods out of warehousing operation is improved. The comprehensive use of geographic location awareness technology and RFID technology, while identifying material identity information, records the geographic location information. Through comparison and automatic analysis of the project demand geographic location and the actual receipt and delivery geographic location, early warning may exist the risk of virtual entry and virtual exit of material items. Using logistics visualization technology, real-time monitoring of receipt and delivery information, in-transit transportation location information. Promote the "national network core" IOT label, apply IOT reading and writing equipment, various sensors, etc. to realize intelligent storage operations, visualization of transportation and distribution, and automation of information collection of equipment in the whole life cycle, so as to improve the overall digital level of power grid enterprises.

5. Conclusion
The application of emerging technologies accelerates the integration of power grid services, the penetration of the Internet and the development of smart grids, making massive data the core factor of production. Learning from the concept of the Internet, with the upgrading and development of the power grid connection scope, connection objects and connection methods, driven by the user demand, there will be a large number of business services based on the power grid as a platform and flexible and diverse business models as a means, and a new energy ecosystem will be derived.

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