ISSN 2706-655X Vol.4, Issue 1: 7-12, DOI: 10.25236/IJFET.2022.040102

# Optimization of the Operation Model of Intelligent Logistics Warehousing and Distribution of State Grid Corporation

**Yanhai Wang[1], Hang Xu[1], Xinyi Wang[2*],Chen Chen[2], Yang Luo[2], Chen Cheng[2], Shihui Luo[2], Dacheng Ju[3]**

*[1]Dept. of Procurement, STATE GRID Corporation of China, Beijing, China*
*[2]China Electricity Council (Beijing) Technology Development Co., Ltd., Beijing, China*
*[3]China Telecom System Integration Co., Ltd., Beijing, China*
*wang_xinyi_123@163.com*
**Corresponding author*

***Abstract:*** *With the economic and social development, the increase in demand for electric power supplies brings great challenges to the warehousing and distribution operation model of State Grid corporations. The rapid development of the State Grid corporations also puts forward higher requirements for its logistics management level. Therefore, optimizing the management of electric power materials warehousing and distribution, realizing the key control of the overall warehousing and distribution link of the State Grid corporations, and promoting the digital operation of intelligent logistics warehousing and distribution model is of great significance to the development of the power enterprise and even the whole power industry. This paper uses PEST analysis to analyze the storage and distribution model of the State Grid Corporation from the macro environment, uses SWOT analysis to analyze the internal strengths, weaknesses and external opportunities and threats encountered by the State Grid Corporation, and gets the strategic direction of material storage and distribution of the State Grid corporations. Finally, suggestions are made for the development of material warehousing and distribution of State Grid corporations.*

***Keywords:*** *Smart Warehousing, Smart Distribution, SWOT Analysis, PEST Analysis*

## 1. Introduction

With the development of blockchain, the Internet of Things, and other emerging technologies, the supply chain began to integrate with smart technology, and smart warehousing and distribution have become a major trend to achieve industrial upgrading and change. Logistics, as part of the supply chain, ushers in the industrial revolution of wisdom transformation. While the power logistics industry is developing rapidly, the scale of the State Grid is expanding, and the types and quantities of power materials are growing dramatically, putting forward higher requirements for warehouse management, and the increasing demand for power materials also brings huge challenges to distribution. Therefore it is necessary to optimize the intelligent warehousing and distribution model of the State Grid Corporation.

Many scholars have studied power material management at the strategic level. Lv Bo etc.[1] uses "intelligent logistics" and logistics operation mode to integrate, and divide the logistics operation mode into transportation and distribution mode, storage mode, express delivery mode, and e-commerce logistics service mode, and build a new logistics operation mode system. Wang Qianqian [2] In the supply chain management of electric power enterprises, the communication between electric power enterprises and material suppliers should be strengthened to coordinate the interests of all relevant parties, complement each other and achieve the purpose of long-term cooperation. Wang Zhanfeng [3] et al. study the problems and solutions in the process of the whole life of the equipment assets of the State Grid Information Technology by sorting out the current situation of the management of the physical assets of the State Grid, and promoting the improvement of the management of the physical assets of the State Grid corporations. Zhang Shuran [4] believes that the ERP system can be used to innovate thinking, break the traditional management mode, make the procurement and management process more flexible, and facilitate better protection of the necessary materials involved in the

ISSN 2706-655X Vol.4, Issue 1: 7-12, DOI: 10.25236/IJFET.2022.040102

production of power enterprises. Zhu Jie [5] proposes that power supply enterprises must implement scientific, low-cost, and information management for the storage and distribution mode of materials.

Some other scholars have studied the management of power materials at the level of technical methods. Yang Shaokui [6] To cope with the loopholes and shortcomings in the management and distribution of traditional electric power materials, it is proposed that the degree of intelligent management of electric power materials can be improved with the help of modern means to enhance the management efficiency and distribution speed. Fan Jiangdong et al. [7] proposed that to improve the material management level and logistics efficiency of electric power material enterprises, vehicle allocation model, vehicle path planning model, and electric power material loading and distribution platform should be established to improve vehicle loading rate and distribution efficiency through-loading visualization and distribution intelligence. Nie Qihe et al. [8] propose the luminescent electronic label that can meet the demand of rapid finding and recognition of electric power materials under complex environment to carry out all-round management of key materials. Sun Xiaojun and Han Chao [9] Construct a lean control system for electricity based on physical ID from the perspective of hardware and software. Xuefeng Guo [10] Proposes the use of an automated three-dimensional warehouse, which can well meet the requirements of electric power material storage management and realize automated and digital management and is worthy of a wide range of promotion and application. Zou Zhijie [11] proposes a strategy to scientifically carry out the supply management of electric power fixed amount materials and emergency materials, to further improve the management level of electric power materials through mobile applications and further improve the management of electric power materials.

Therefore, based on the theoretical basis related to warehousing and distribution, this paper uses PEST and SWOT analysis methods to analyze the internal and external environment of the warehousing and distribution business of the State Grid. Finally, optimization suggestions are made to improve the modern intelligent logistics warehousing and distribution model with the characteristics of State Grid and to improve the quality and efficiency of logistics warehousing and distribution of State Grid corporations.

## 2. Opportunities and Challenges in the Warehousing and Distribution of State Grid Corporation

### *2.1 Opportunities in the Warehousing and Distribution*

Policy support to promote the development of intelligent robots. In recent years, government departments have also launched policy documents for intelligent robots to encourage their development. In July 2017, the State Council issued and implemented the Development Plan for a New Generation of Artificial Intelligence, which clarifies the strategic goals for the development of a new generation of artificial intelligence in China. By 2025, the basic theory of artificial intelligence will achieve a breakthrough, some of the technologies and applications will reach a world-leading level, artificial intelligence will become China's industrial upgrade and economic transformation, and positive progress in the construction of an intelligent society; by 2030, AI theory, technology, and applications will reach a world-leading level in general and become a major AI innovation center in the world.

Economic and social development promotes the development of intelligent storage and distribution. With the continuous development of China's urban economy, the consumption level of urban residents has also been substantially improved, and the distribution model is changing. According to Azure Capital's calculations, the market size of China's terminal unmanned delivery market reaches about 84 billion yuan. Faced with the advantages of delivery robots and the abroad market, more and more companies are getting involved in the field of unmanned delivery.

Technology development to promote intelligent management. Based on the application of industrial Internet, big data and 5G technology, will provide a basic channel for the industrial-level interconnection of everything, to promote the intelligent control of storage equipment and flexible applications, and the application of cloud, edge computing, Internet of things technology, so that more equipment into the network, to achieve material information sharing. At the same time, the information system is established to open up the data barriers in all aspects of the enterprise, improve the enterprise's management of the entire life cycle of materials, especially the storage chain, circulation, and production process, effectively improve the traceability of material circulation and improve the overall level of storage management.

ISSN 2706-655X Vol.4, Issue 1: 7-12, DOI: 10.25236/IJFET.2022.040102

### *2.2 Challenges in the Warehousing and Distribution*

The implementation of supporting management systems at the grassroots level is not synchronized. In the process of implementing the transformation work requirements at the grassroots level, the original management system and business processes of the State Grid Corporation cannot adapt to the new technology and new equipment and still need to make specific adjustments in combination with industry characteristics, enterprise characteristics and business characteristics. The rhythm of grassroots management system improvement, business process reshaping, and technology innovation on the ground is not consistent, which affects the efficient and high-quality development of the material storage and distribution management business of the State Grid Corporation.

Lack of lean planning for the introduction of advanced technologies. Under the guidance of national policies, modern information technology and advanced communication technology, such as "big cloud, material, mobile and intelligent chain", are increasingly associated with the State Grid Corporation, but the relevant investment and construction inevitably have difficulties in landing. In the smart warehouse construction and transformation, due to the variety of power materials, not only the pursuit of advanced technology, for domestic and foreign excellent enterprise wisdom transformation experience, should be dialectical thinking, learning, to combine the actual needs, polishing planning solutions. A single stack of automation equipment will instead affect the efficiency of work and hinder management improvement.

The value of State Grid materials warehousing and distribution data is not explored in depth. Compared with Ali, Jingdong and other large domestic enterprises leading supply chain management model and advanced hardware and software facilities, subject to the characteristics of the industry, State Grid warehousing management wisdom level is still lagging, internal data remains in the collection and integration stage, data analysis for supporting decision-making help is not obvious, and the use of data information is still a single scene, there is still a lot of space to explore the value of data.

## 3. Advantages and Disadvantages of Warehousing and Distribution of State Grid Corporation

### *3.1 Advantages of Warehousing and Distribution*

(1) Platform advantages

The construction of the "5E and one center" platform of State Grid Corporation has been preliminarily completed. The modern smart supply chain of State Grid Corporation is a modern supply chain system supported by the "5E and one center" supply chain platform, That is, the electronic commerce platform (ECP) is implemented on the whole business line to realize the "one line of business" of the supply chain; the enterprise resource management system (ERP) promotes the integration of industry and finance to realize the "one game of resources"; the electrical equipment intelligent platform (EIP) cooperates with suppliers to realize the "one network"; the power logistics service platform (ELP) shares with logistics providers to realize the "one network of logistics"; "e material" handheld application to realize "mobile integration"; The supply chain operation center (ESC) is interconnected with the "5e" and becomes the "management center" of the supply chain. Through the operation of the integrated platform, breaks the boundaries of various professions, promotes business integration, advances information sharing, and effectively supports the efficient operation of the modern intelligent supply chain.

(2) Industry advantages

As China's urbanization accelerates, the electricity demand grows steadily and the growth rate of electricity consumption begins to rise. This has stimulated the innovative energy of the State Grid Corporation and promoted clean, low-carbon, safe, and efficient operation of the electric power industry. In addition, the rapid development of infrastructure construction and even more rapid development of power infrastructure, extra-high voltage grid has been built into the backbone of the State Grid, the coordinated development of State Grid at all levels, a certain capacity in infrastructure has been achieved, technology has achieved various breakthroughs, management continues to move towards modernization, etc., all of which provide strong support for the development of State Grid.

### *3.2 Disadvantages of Warehousing and Distribution*

(1) Difficulty in managing the whole life cycle of power materials retroactively

ISSN 2706-655X Vol.4, Issue 1: 7-12, DOI: 10.25236/IJFET.2022.040102

Due to the characteristics of State Grid's power materials supply channels, a wide range of material categories, a large number of materials, and various modes of transportation, it is difficult to realize the management of the whole life cycle of power materials from material procurement, storage management, logistics and distribution, operation and maintenance management to end-of-life disposal. At the same time, to ensure the safe and stable operation of the State Grid, the State Grid Corporation distinguishes between the internal network and the external network and implements physical isolation, which makes the internal and external networks flow poorly. At the same time, the diversity of systems in various departments and the lack of uniform data standards lead to poor data sharing within the enterprise, which has certain constraints on the efficiency of material management.

(2) Unscientific design of storage space for electrical materials

Grid construction from construction to operation often involves all kinds of power materials, but because most of the materials production cycle is long and the supply is susceptible to the market, it is impossible to use zero inventory management, and can only be managed in the form of material reserves, and storage position management has become an important means because of its impact on picking operations and access to storage efficiency. However, in the actual power supplies in and out of the warehouse operation, supplies do not have relatively fixed storage areas, nor are they classified according to the relevant characteristics of the supplies, often only by the experience of veteran employees, subjective feelings, or preferences of the power supplies storage location for perceptual arrangements, supplies are issued and received dependent on manual operations.

(3) Data sharing and information security are difficult to guarantee

Data is difficult to share. Due to the lack of data interaction channels between the information systems of electric power material majors, various business data are scattered among the systems, which makes it difficult for the competent project units to obtain material supply status information during the control process of key projects of the State Grid Corporation, to overview the overall progress of the project, to quickly locate abnormal business points, to obtain urgent demand information, and to make an accurate judgment and follow-up processing; and such information lacks corresponding interaction mechanisms and management specifications, resulting in a low degree of information synergy and linkage, which prevents the improvement of customer service level. This leads to a low degree of information collaboration and linkage, which prevents them from accurately grasping the project status, restricts the improvement of customer service, and is not conducive to the optimization of the business environment.

## 4. Strategic Direction and Optimization Suggestions for Warehousing and Distribution of State Grid Corporation

### *4.1 Strategic Direction of Warehousing and Distribution of State Grid Corporation Based on SWOT Analysis*

Based on the description of the opportunities and challenges of the external environment and the internal strengths and weaknesses of the company, a SWOT analysis was used to develop a material storage and distribution strategy.

#### *4.1.1 Strength-Opportunity Strategy*

(1) Based on national policies, play the advantages of leading electric power enterprises and guide the whole chain of intelligent change in the electric power industry.

(2) Make full use of the "5E and One Center" and existing technologies to achieve comprehensive sharing and efficient collaboration in warehousing and distribution.

#### *4.1.2 Weakness-Opportunity Strategy*

(1) Consolidate the development of the warehouse and distribution business by following politics and technology.

(2) Improve the construction of the "5E and One Center" to promote better development of warehousing and distribution.

#### *4.1.3 Strength-Threat Strategy*

(1) Make full use of the existing "5E and One Center" to manage the storage and distribution of the

ISSN 2706-655X Vol.4, Issue 1: 7-12, DOI: 10.25236/IJFET.2022.040102

State Grid Corporation.

(2) Strengthen material storage and distribution planning, promote the unification of power platforms and actual information, and ensure safety and quality control.

#### *4.1.4 Weakness-Threat Strategy*

(1) Accelerate the reform of institutional mechanisms to achieve intelligent and digital development of warehousing and distribution.

(2) Summarize the experience of advanced enterprises, introduce information technology and intelligent technology, and promote strategic reform of enterprises.

#### *4.1.5 Strategic Direction*

Accordingly, the strategic direction for the development of material storage and distribution of the State Grid is summarized as follows.

(1) Driving the Internet of Everything with technological innovation

Focusing on the development strategy of the State Grid Corporation, upholding the concept of independent innovation, taking the integration of new-generation information technology and products as a breakthrough point, deepening digital technologies such as perception, virtual reality, robotics, voice image recognition, big data, cloud computing, and 5G communication, actively developing intelligent interconnected products with memory, perception, calculation and transmission functions, and realizing real-time perception and online interconnection of facility and equipment status. Using technologies such as intelligent sensing, collect information data of the whole process of material warehousing and distribution to provide effective support for quality control, service collaboration, data mining, and value creation for both supply and demand. Thus, it truly realizes the "interconnection of everything" and "comprehensive and deep integration" of digital information in all aspects of warehousing and distribution, realizes the whole life cycle management of materials and data traceability of the whole business chain, and enhances the core competitiveness of warehousing and distribution of State Grid.

(2) Improve the construction of "5E and One Center" to promote management improvement

With the support of modern supply chain management theory and relying on the technology of "big cloud, material, mobile, and intelligent edge chain", the State Grid Corporation should continue to improve the construction of the "5E and one center" platform, realize information integration and transparency and enhance the company's collaborative ability. Improve the degree of visualization of the whole process, share the whole network logistics resources, and then improve the level of storage and distribution. Ultimately, it will lead the power logistics platform and the ecosphere to build a "centralized, unified, lean and efficient" management system, comprehensively build a harmonious and win-win supply chain ecosystem, realize a modern supply chain intensive control system, realize the interconnection of everything, everyone, and everyone, create data value, and improve the entire supply chain ecosystem. Quality and economic benefits.

### *4.2 Optimization Suggestions for Warehousing and Distribution of State Grid Corporation*

#### *4.2.1 Promote the Application of New Technologies and Equipment*

(1) "Cargo-to-Robot" picking system

The use of "cargo to robot" picking system makes the warehouse work more efficient, locating the goods and arranging to pick out, returning and replenishing them as quickly as possible, making full use of time and improving the quality of warehouse picking; it also saves the warehouse's human resources, reducing the investment in manpower, and replacing the picking staff in the warehouse with robots, improving picking accuracy and speed. It also saves human resources in the warehouse, reduces human investment, replaces pickers in the warehouse, improves picking accuracy and speed, responds to customer needs as quickly as possible, and realizes goods-to-man technology; the "goods-to-robot" picking system picks accurately, with almost zero cargo loss or difference, and ensures maximum cargo security.

(2) 3D digitization of warehouses

Through the warehouse 3D, digital modeling can be warehouse shelves, cargo space, and hardware equipment in the form of 3D models to intuitively show the user. Users can combine the data modeling

ISSN 2706-655X Vol.4, Issue 1: 7-12, DOI: 10.25236/IJFET.2022.040102

information with business data in the handheld application platform, which can intuitively display and analyze the warehouse operation condition. At the same time, the 3D coordinate data can provide basic data support for cargo management, path optimization, and vehicle navigation.

#### *4.2.2 Automatic Traceability Based on ID Codes*

Based on the "5E and One Center" supply chain platform, the company takes a physical ID as the link and applies industrial IOT technology to solidify the classification correspondence among materials, equipment, and assets, realizing the interconnection of physical ID code, project code, WBS code, material code, equipment code, asset code, dispatch number, and scrap material code. Strengthen the collection of process data and quality data in the life course of electric power materials, to realize information sharing and traceability of electric power materials in the whole life cycle of material procurement, manufacturing, logistics service, operation and maintenance, retirement, and scrapping, and recycling, realize the whole life cycle management of assets, promote the cooperation of upstream and downstream enterprises in the industry chain, and build a new industry model with the real-time matching of demand, real-time business cooperation, and real-time data interaction. In addition, it will form an automatic traceability system based on ID codes.

#### *4.2.3 Blockchain Guarantees Secure Data Sharing*

There are many node enterprises in the material supply chain, and in the face of huge real-time information and collaboration needs, each node enterprise in the chain needs to always maintain the interconnection of supply chain information. Blockchain can break the traditional supply chain "information island", realize the decentralization and de-trust information sharing of the power material supply chain, through building blockchain, a new data management technology with sharing, security, and transparency, and then ensure the cooperation and information sharing among all subjects of the power material supply chain.

## References

*[1] Lv Bo, Fan Xinkai, Han Jian. Research on the new operation mode of "smart logistics" and enterprise integration [J]. Business Economics Research, 2020(09):108-111 (in Chinese)*
*[2] Wang Qianqian. The management method and innovation of power enterprise material supply chain [J]. Modern Enterprise, 2021(09):14-15 (in Chinese)*
*[3] Wang ZF, Zhao XIL, Yan F et al. Data traceability and database design in the whole-life process of power grid assets [J]. Electronic Technology and Software Engineering, 2021(04):154-155 (in Chinese)*
*[4] Zhang Shuran. The use of ERP system to improve the level of information of power materials management [J]. China Management Informatization, 2021, 24(21):110-111 (in Chinese)*
*[5] Zhu J. Problems and solutions of material distribution management in power supply enterprises [J]. Transportation Manager World, 2020(07):30-31 (in Chinese)*
*[6] Yang Shaokui. Research on the application of intelligent management and distribution system of power materials [J]. Technology and Innovation, 2021(01):130-131 (in Chinese)*
*[7] Fan JD, Xu JB, Sun SJ. Intelligent procurement and distribution of distribution network materials based on the theory of constraints [J]. China circulation economy, 2019, 33(03):91-101 (in Chinese)*
*[8] Nie Qihe, Zhu Yunliang, Jia Shuo et al. Research on the application of power material storage management based on luminescent electronic tags [J]. China integrated circuit, 2021, 30(07):44-49 (in Chinese)*
*[9] Sun Xiaojun, Han Chao. Design of a lean control system for electric power based on physical ID [J]. Bonding, 2021, 46(04):162-165 (in Chinese)*
*[10] Guo Xuefeng. Application of automated warehouse in power material storage management. China new communications, 2021,23(13) : 137-138. (in Chinese)*
*[11] Zou Zhijie. Research on the application of mobile applications in the material management of electric power enterprises [J]. Technology and Market, 2021, 28(08):166-167 (in Chinese)*