Discussion and Research on informatization of Power Grid Infrastructure Project management

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Abstract: With the rapid development of China’s economy, the electric energy demand is increasing, and in recent years, it has been in the stage of rapid construction of power grid projects. Xiongan New Area begins to build substantively, and its tremendous leading and demonstration effect will gradually play a role. In the future, power grid construction will surely develop towards higher quality and efficiency. It is an inevitable trend to adopt advanced information technology to carry out project management. This paper will elaborate the related contents of power grid infrastructure project management and information management, make a thorough analysis of the current situation of power grid infrastructure project management informatization, discuss several factors that restrict the development of information technology, and put forward substantive suggestions for improving information management. Finally, this paper presents a management information system for power grid infrastructure projects.

1. Preface
The power grid infrastructure project has the characteristics of capital intensive, technology intensive, resource intensive, professional and cross construction. At the same time, the relationship between the project and the environment is increasingly close, and the security risk is increasing day by day. In order to reasonably plan, organize, coordinate, control and manage all aspects of the project construction, it is necessary to clarify the problems existing in the management of power grid infrastructure projects and improve the management level relying on advanced technical means.

With the advent of the information age, project management is bound to move towards information management, and the core competitiveness of project management is increasingly dependent on information technology. Only by making full use of high and new technologies including information technology to promote the informatization of project management, can we enhance the ability of project management and enhance the competitiveness.

In recent years, the application of information technology in power grid infrastructure project management has made great progress. We have carried out a lot of information application exploration and achieved certain results, but there are still some problems. In order to solve these problems, it is necessary to clarify the significance of information management, discover and solve problems in time, and improve the informatization level of power grid infrastructure project management. Therefore, this paper discusses the informatization construction of power grid infrastructure project management.
2. Brief introduction of power grid infrastructure project management informatization

2.1 Power grid infrastructure project management

Project management refers to the whole process, comprehensive planning, organization, control, coordination and supervision of the project implementation in order to achieve the project objectives (achieve the required quality within the specified time and budget cost) under certain constraints.

After the 5.7 and 5.14 safety accidents, SGCC implemented 12 supporting policies for infrastructure construction and carried out large-scale infrastructure system reform. Construction branches were set up at provincial level and project management centers were set up in municipal companies to separate functional management from project management. Power grid infrastructure project management is facing a new situation. At present, all units are actively adapting to the new changes based on the twelve supporting policies, and at the same time, they are exploring more efficient management mode.

2.2 Information management

Information management is not a simple combination of high-tech means and old management mode, but to achieve management objectives with high quality and high efficiency as the center, flexible application of information technology, innovation of management system and organizational behavior driven by informatization, deep integration of information technology and new management mode, reintegration of internal and external resources, and improvement of enterprise efficiency and efficiency.

2.3 Information content

(1) Document and data management informatization: Taking the whole life cycle of the project as the object, all information is paperless, and a database for storing all the engineering information is established. The information is automatically stored according to the progress node, which is convenient for subsequent information retrieval, and the information traceability mechanism is established. It is easy to establish and share knowledge base for experts.

(2) Engineering information processing and visualization: the amount of infrastructure project information data is huge, and the correlation of various types of data is complex (Fig 1). It is necessary for project managers to make correct decisions by extracting useful data from huge data stream and analyzing the correlation among various types of data. The project overview, project progress, obstacles, safety and quality and other information are visually displayed to facilitate the management personnel to carry out the meeting display and the relevant participants to understand the relevant situation of the project, so as to improve the management efficiency.

(3) Establish an effective communication channel through informatization: establish an Internet-based management information system to enable all parties involved in the project to submit
and receive information through the network and electronic media. Establish communication and cooperation platform, so that all parties involved in the project can communicate remotely and solve problems in time.

(4) Process control Informatization: establish real-time monitoring system to realize remote expert consultation and remote command of project site. To establish a scientific pre control system, in the process of project management, according to the processing of engineering information and relevant engineering experience, predict the possible problems in the next step, so that all parties involved in the construction can timely adjust the plan and make decisions to avoid serious losses.

2.4 Characteristics of power grid infrastructure project management informatization

2.4.1 It involves a wide range of work and a large amount of work
Power grid infrastructure project management involves many departments and professions. It not only includes the production management in the construction process, but also involves the management contents of design, safety, quality, materials, planning and settlement. Project management is to go deep into these management contents, but also to do all aspects of the overall consideration, the workload is imaginable.

2.4.2 Strong restriction
Project management must be in line with the internal law of construction from preparation to completion. The process of project implementation involves all aspects of work, which has its internal connection and constraints. How to find the connection and restriction points from these details is a test of the quality of management personnel. In addition, the government and superior companies have more regulations and document constraints on power grid infrastructure projects. Therefore, the project management should meet the requirements of the relevant specifications of electric power engineering, so that all parties involved in the construction can cooperate with each other, and all aspects of the project are arranged orderly.

2.4.3 Large amount of information flow
The management activities of power grid infrastructure projects are interdependent and mutually restricted (Fig.2). Therefore, it is necessary to exchange and transfer information between management activities. The complexity and heavy degree of work directly determine the complexity and frequency of information flow in the process of project management.

Figure 2. Massive data source
3. Development status of power grid infrastructure project management informatization
In recent years, the application of information technology in power grid infrastructure project management has made great progress. The State Grid infrastructure management information system, personnel management system and video monitoring system have achieved good results. Many provincial and municipal companies have also established their own infrastructure management systems to improve the efficiency of infrastructure project management.

At present, the application of information technology in construction project management mainly embodies three aspects. The first is the application of Internet database technology. The massive information in the progress of the project can be stored and queried quickly. The second is the application of advanced monitoring system. The camera monitoring system is used to cover the whole construction site to monitor the safety and engineering quality of the construction site, which not only reduces the management difficulty of the construction site, but also improves the project management efficiency. Thirdly, the application of personnel identification system. Using face recognition, real-time positioning and other high-tech means to strengthen the management of construction site personnel.

4. Suggestions on informatization development of power grid infrastructure project management

4.1 Training Interdisciplinary Information Technology Talents
Information technology, like other industries, needs its relevant personnel to have some basic information technology skills. However, the personnel who only have information technology skills can not meet the requirements of high-quality talents of project management informatization, and they should also have professional knowledge of project management and understand the situation of construction site. We can strengthen the construction of interdisciplinary talents by organizing training courses, increasing relevant professional education content, online training, knowledge popularization and other forms.

4.2 Strengthen the application of project management information technology
Strengthening the application research of project management information technology, especially the research of key technology, is the key to realize the informatization of project management. In the process of project management informatization, voice recognition technology, face recognition technology, geographic information system technology and other information technology can be used for project management. Application research should focus on project management, closely around the needs of project site management, and resolutely put an end to the informatization that blindly pursues high technology and high investment but deviates from the actual project management.

4.3 To reduce the burden of project management personnel as the goal
Project management informatization should become an effective management support means for project management personnel. Combined with management innovation, it can reduce the work pressure of management personnel and improve management efficiency. Some management systems do not play a role in enhancing management efficiency, but increase a lot of workload for managers, which is one of the main reasons why it is difficult to implement effectively. Based on project management, combined with advanced information technology, management innovation should be carried out to form an effective and convenient new mechanism for project management.

4.4 Provide a good external environment for project management informatization
Under the opportunity of building ubiquitous power Internet of things of State Grid, it is necessary to study and establish a safe and effective internal and external network application mechanism to make the project management information flow more smooth and reduce the resistance of project management informatization. In addition, it is necessary to study and formulate relevant regulations of
project management informatization to standardize and guide the development and application of informatization.

5. Exploration of a management information system for power grid infrastructure projects

Establish an effective database, with the project management center as the main application body, with the help of mobile phone terminal app and computer version software, with the plan implementation process as the main line, integrate and summarize the relevant data of the project site, form the records of the whole management process, and form the information traceability mechanism. An information display and sharing platform is established to display and analyze engineering information visually and intelligently. Build a communication platform for all parties involved in the construction to improve the efficiency of solving engineering problems. Establish report auto generation and integration engine to reduce the burden of project management personnel. Project management personnel rely on the system to achieve a comprehensive control of the project site. The function details are as follows:

| Working stage          | job content                                      | Achievements                                                                 |
|------------------------|--------------------------------------------------|------------------------------------------------------------------------------|
| System scheme and      | Programming                                      | A set of reference                                                          |
| overall design         | Overall design of the system                     | substation site intelligent management scheme                               |
| Development of hardware| Equipment Selection                              | Develop and verify a set of mature, stable, expandable and popularized      |
| equipment              | Equipment development                            | integrated supervision equipment                                              |
| Software function      | Scene electronic map and video                  | Automatic record and video                                                  |
| development            | positioning panoramic monitoring                 | linkage of people and vehicles in and out                                   |
|                        | Automatic record and video                      |                                                                               |
|                        | linkage of people and vehicles in and out        |                                                                               |
|                        | Automatic monitoring and                        |                                                                               |
|                        | recording of violations                          |                                                                               |
|                        | Remote control                                   |                                                                               |
|                        | Supporting development interface                 |                                                                               |
|                        | System debugging test                            |                                                                               |

5.1 Planning and Implementation

Before the commencement of the project, the project plan is compiled by software to determine the major nodes of the project. It is convenient to adjust the project plan, and there are traces of the plan adjustment. During the construction process, the project manager adjusts and corrects the project
according to the project plan. It supports the preparation of annual, monthly, weekly and temporary power outage plans, and reports them to the plan specialist. It has the functions of audit, rollback and summary, and the system automatically analyzes the implementation rate of project power outage plan.

5.2 Automatic report generation and integration
The construction and supervision personnel input individual project information in the mobile app, and after the approval of project management personnel, the system automatically completes the generation and integration of reports required by management personnel at all levels, including safety daily report, weekly report and monthly report. Each project is mainly to fill in the data, supplemented by the preparation of text.

5.3 Engineering problem list
The problem management module is mainly used to record and manage the problems encountered in the actual construction of a project. When the problem is entered, the node information to which the problem belongs should be selected to record the problem under which project node occurred, so as to facilitate the system record archiving and project traceability. The project manager records the solving process of the problem, uploads the minutes of the meeting held and the solutions adopted around the problem.

General problems are recorded as internal problems of the engineering department, and the project manager can record the problems and track the progress of the problems until the problems are solved.

5.4 Engineering information display
Before the commencement of the project, input the project overview information, including the basic project overview, single project, line crossing information, route information, key point implementation plan and project address book. Mobile app and computer software are displayed simultaneously, which is convenient to understand engineering information at any time.

Explore the visualization display of the project information under the jurisdiction of the project management center, and analyze the integration of a number of projects under the jurisdiction of the project management center. All projects can be summarized to facilitate information statistics. The materials that need to be displayed in each project are convenient for LED large screen visualization display.

5.5 Form the basis of performance appraisal
The software records the implementation of the project plan, records the adjustment and correction of the project plan, and records the processing data of the problem list. Through the processing and analysis of these information, the evaluation of all parties involved in the construction and the performance evaluation of the project management personnel of the construction and management unit are formed.(Fig.3)
6. Summary
Project management informatization is a systematic project, involving project management concept, personnel quality, national and industrial policies and regulations, high-tech information technology, application environment and other elements. In order to make full use of information technology to solve the difficulties encountered in conventional project management and improve the level and efficiency of power grid infrastructure project management, managers should master the relevant knowledge of information management, boldly innovate, and constantly improve in the practical application of information technology.

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