

Informatization Management System for Rail Transit Construction

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Abstract. With rail transit construction developing by leaps and bounds in China, the traditional project management model has shown discomfort. Informatization management, the modern concept of project management, provides a new management model for rail transit construction management and becomes an effective way to change the shortcomings of traditional project management. This paper bases on the analysis of the characteristics and requirements of the rail transit construction management, presents the informatization management system based on integrated management thoughts and analyses its overall frame and operation mechanism - virtual reality, decision support and dynamic control. Then, it proposes to strengthen the constructions in three aspects including the organizational and institutional, runtime environment of informatization platform and informatization technology to ensure the informatization management system of rail transit construction running safely and smoothly.

Keywords: Rail Transit Construction, Informatization Management System, Informatization-Plat, Integrate

1. Introduction

Since the founding of New China, the urban rail transit construction has been an important part in the development of urban construction. In recent years, the construction of rail transit in China can be described as leapfrog development. However, a significant link in the railway construction, rail transit construction management, has a direct impact on the development of railway construction.

Rail transit construction management directly related to and affects various aspects of the rail transit construction, such as duration, investment, quality and so on. At present, the level of informatization in Chinese rail transit project construction management is still in a backward state. This brings about some problem like informatization silos, low level of informatization sharing, imperfect informatization management system and other issues, which seriously hamper further rapid expansion of the railway industry. With the continuous improvement of Chinese railway construction, traditional ways and means to manage cannot meet the needs of modern construction management informatization. Now it is imperative to realize of informatization of Chinese rail transit construction management.

2. The Advances of Informatization Management

The drawback of traditional project management can be solved effectively through the establishment of informatization management system. It plays an important role on realizing integrated management. It includes the following advantages.

(1)Facilitate the Implementation of Integrated Management and Maximize the Overall Effectiveness. Construction informatization management platform can achieve a complete collection and share of all informatization on the platform about construction. It facilitates the implementation of whole- process management in rail transit construction from project decision-making, designing, constructiong, and various stages of completion and acceptance, quality warranty and so on. Otherwise, it optimizes resource allocation and conduct dynamic risk management during the whole process combined with environmental factors to maximize benefits.

(2)Reduce Information Barriers. There will be generating a mass of legal contracts, purchase orders, financial documents as well as involve a number of organizations, majors and process during whole life period of construction. But most of data and information isolate from each other and lack mutual association. Comprehensive informatization needed by the project decision-making is difficult to extract, which lead to the formation of a "islands of information", resulting in information barriers in different organizations, professions and process.

(3)Reduce Communication Costs. Rail transit construction project involves many stakeholders. There can be hundreds of stakeholders in large-scale projects, which are hardly in the same geographic area. It would take much expense on communication between relevant units cross regional traditional communication

means, such as long distance telephone, fax and mail. While having face-to-face meeting will cause higher travel expenses and spend more time on travel.

In addition to high management costs caused by cross-regional coordination, data and informatization management will also take huge cost. According to statistics, a typical \$ 100 million project will produce 150,000 copies of data and information (Zhao, 2010). Even if some construction unit apply computer in disposing information to a certain extent, the manner they pass is still paper. So many documents take up enough space to save, spend a lot office expenses to print, copy or something else. After the completion of the project, it is necessary to take intensive resource, human and material resources to manage.

3. The Frame and Operation Mechanism of Rail Transit Construction Informatization Management

3.1 The Frame of Rail Transit Construction Informatization Management

The rail transit construction informatization management system serves for various interests' clients such as survey and design units, construction units, supervision units, consulting units and other stakeholders to achieve comprehensive core functions of rail transit construction management by establishing the informatization management platform, which will be supported by the database, knowledge base and model library of the integrated project management. It serves for project planning, decision-making, construction, implementation, operation and maintenance during the whole lifetime of the structure shown in Figure1.

The purpose of establishing informatization management system of rail transit construction is to form favorable atmosphere for the interaction between stakeholders and the informatization management platform. The core functional area is informatization management platform, which is mainly constituted of nine subsystems: target management, contract management, benefits management, finance management, collaboration management, e-commerce, risk management, knowledge management and facilities management (Chen, 2010).

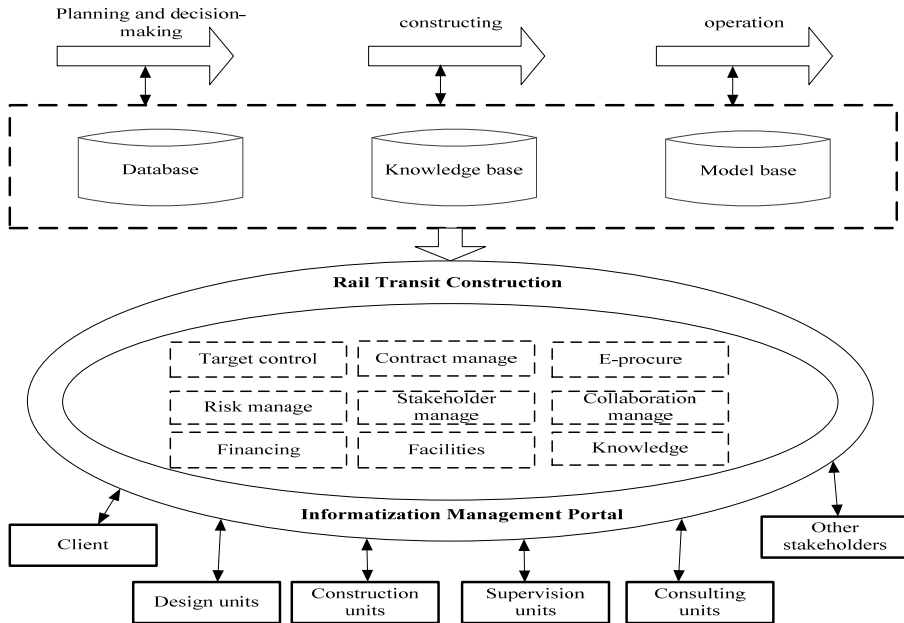


Fig. 1. Overall Structure of the Rail Transit Construction Informatization Management System

3.2 The Technical Support of the Rail Transit Construction Informatization Management System

It is indispensable to get digital information technology support for establishment of information management platform. BIM, Building Information Modeling is a new method of engineering design, construction and management. It can connect information and resources generated in various stages of life-cycle into a three-dimensional or multi-dimensional information model, which is able to achieve information sharing. Therefore, BIM helps rail transit projects to improve management efficiency, reduce risk and implement collaboration management, which will greatly improve the efficiency and effectiveness of construction and management. The application of BIM technology has the following advantages.

(1) Multi-dimensional integration. BIM is a Multi-dimensional integrated information model (Wang, 2011). BIM establishes the time and cost dimension based on schedule management and cost management information technology, and it links three-dimensional space with time and cost dimension together based on traditional 3D model to form the multi-dimensional information management mode, which can improve the level of total life cycle management, total aspects management and total factor management. The multi-dimensional information model structure is shown in Figure 2.

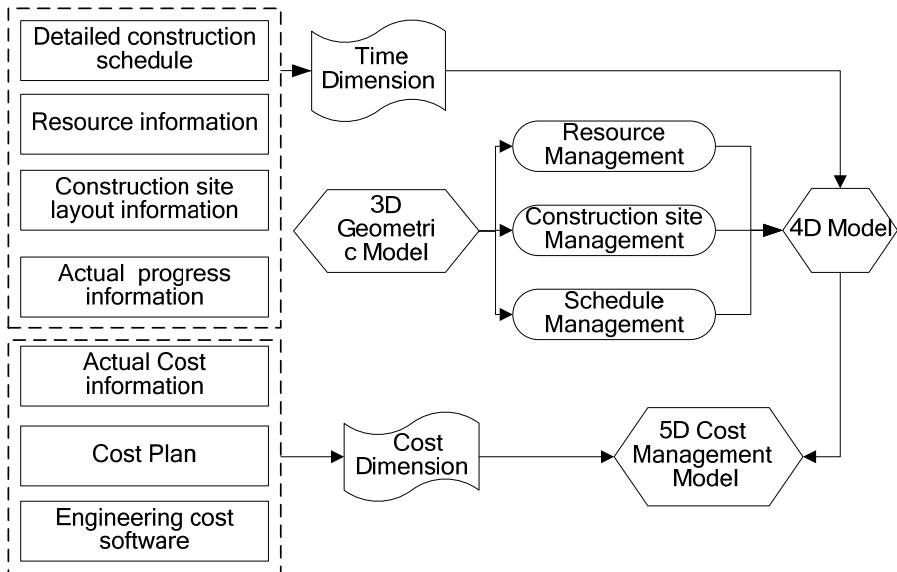


Fig. 2. Multi-dimensional information Model Structure Based on BIM

(2)Information sharing. In BIM, all project elements are organic combined into an information model and centralized storage in one or more databases. The information of rail transit construction input to the information management platform in the form of graphics, numbers and text, so that all stakeholders are able to grasp of the dynamics of the construction timely, comprehensive, which facilitates the communication and coordination among stakeholders.

(3)Visualization. With the 3D visualization model of BIM, rail transit construction is able to achieve visualization and process simulation in the design phase, which facilitates the scheme comparison and selection. More importantly, the Multi-dimensional visualization model can throughout the life-cycle management including design, construction, and operation. 4D (four-dimensional) technology of BIM links three-dimensional space with time dimension together. By 4D technology, it can simulate the construction process to forecast errors and conflicts in time and spatial dimension of the construction sites.

3.3 Operation Mechanism of the Rail Transit Construction Informatization Management System

With the technical support from BIM, The informatization management system supports managers for total life cycle management, total aspects management and total factor management. The operation mechanisms are as Figure3.

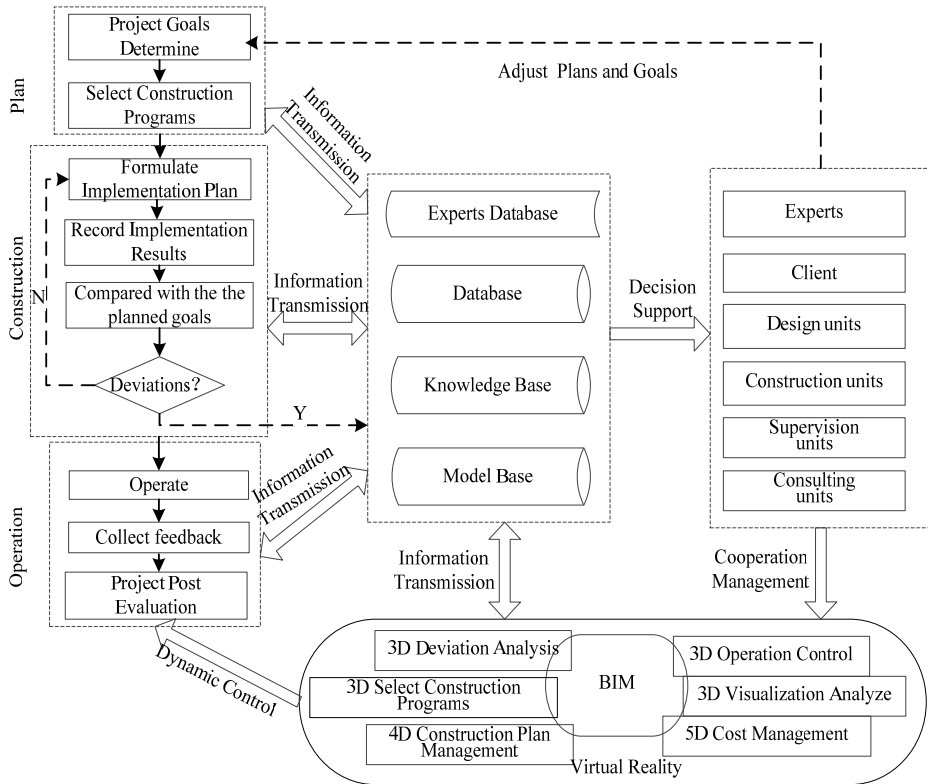


Fig. 3. Operation Mechanism of Informatization Management System

(1)Decision Support (Perumal, 2010). Decision support functions of the informatization of the rail transit project management system can be achieved through the data, models and knowledge by the auxiliary decision-makers and semi-structured or unstructured decision-making human-computer interaction. This can maximize the artificial intelligence and advantages of the experts, combining qualitative and quantitative analysis organically and utilizing and managing knowledge effectively.

(2)Dynamic Control. The most representative features of the rail transit construction informatization management system exist in the timeliness and accuracy of the informatization feedback and that the process of project implementation can be quickly reflected in the platform. Compareded actual versus plannedwith test objectives to find oue whether the execution of a negative deviation occurs, take prospert measures for correction.

(3)Virtual Reality. The rail transit construction informatization management system introduces the relevant technical managers into the program development and optimization of the process based on virtual reality technology, the formation

of a virtual environment through dynamic modeling and visualization technology. It maps out the virtual environment in real-time using the data generated by the various stages of the program and utilizing virtual reality technology in real-time, efficient multidimensional interactive features. It will feed the implementation of the program back timely to the technical managers through virtual peripherals. The technical managers adjust the design process based on the feedback and their own experience and theoretical judgment. After several cycles, a practical, reasonable construction and operation program will be designed eventually.

4. Implementation Safeguards of the Rail Transit Construction Informatization Management System

4.1 Organizations and Institutional Assurance

(1) Form a "flat" organization system which focuses on client. Informatization management system stresses on authorizing project cooperated-building parties and inspires related personnel to develop their capacities. Moreover, it can change the traditional vertical organizational structure into a flat and network forms of organization. Flattened organization structure emphasizes on employee and stakeholders involvement, authorized, teamwork, informatization sharing, as shown in Figure 4 (Huang, 2010).

1) Focus on the client. The construction of the informatization management system requires full participation. Clients are responsible for the total integration of management process and the organization of the production process in construction project. So they are the keys to promote the implementation of informatization system in the construction project. To promote informatization management system, the client should fully pay attention and support the implementation actively so that the practice of digitized work will have a reliable backing, and this is also an important condition to realize informatization management system.

2) Full-participation. Implemented, it is difficult for informatization management system of construction projects to play its role relying on the clients unilaterally. The effect is not ideal in the implementation. Thus it is necessary for the stakeholders to involve in the informatization system and cooperate with the clients actively so that the informatization system can be in full operation.

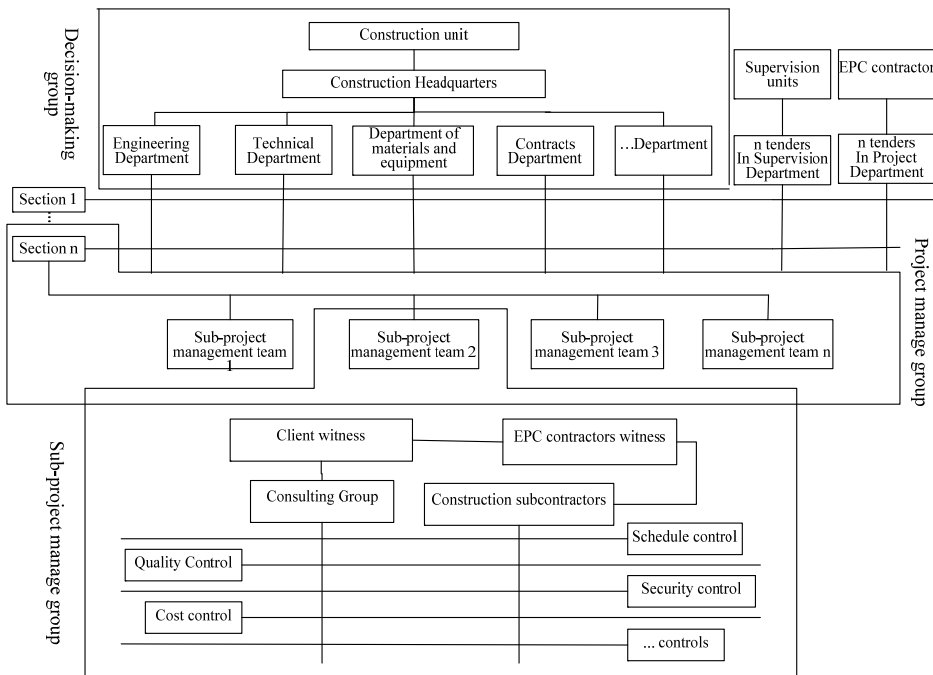


Fig. 4 Flattened Organization Structure the Rail Transit Construction Informatization Management

(2) Institutional Guarantee of Management System. To realize the informatization of construction project management, it is not enough to establish a variety of informatization management platform, it is also necessary for involved parties to establish specialized organizations matching with the implementation of the platform and to develop appropriate rules and regulations to collect data within the enterprise. Therefore they can operate programmatically and normatively to ensure the implementation of informatization management system in construction project. Each relevant management personnel in the system are necessarily restrained, the behavior of personnel should be regulated to ensure the smooth implementation of the informatization system. These can be realized by making matched management system, such as digitized platform work norms, operational processes, informatization security system, right and interest allocation mechanisms related to informatization initiatives.

4.2 Improve the Basic Environment of Informatization Platform

(1) Establishing informatization resources plan. To build informatization-plat, firstly, we need to establish informatization resources planning to sort out project processes, clear the information connections among participants, and set up platform model. Then use the model to measure the existing database and its application. Integrate and inherit the

qualified ones, and optimize the unqualified ones. And then combined with the implementation of the project, optimize and adjust the ongoing process to eliminate some of the unreasonable and redundant processes, ensuring that project information could sharing timely and accurate (Yang, 2009).

(2) Protecting data security. Building the Informatization-Platform will need prodigious cost, high technology supporting and much information from a large number of stakeholders. It is necessary to establish and improve network management and security for the system to ensure informatization security, such as the deployment of network management system, such as firewall, virus protection system and so on.

4.3 Strengthen Information Technology Support

The implementation of informatization management system cannot do without the protection of network infrastructure. The government should increase investment in network infrastructure which is the foundation of the application of Informatization-Platform.

(1) To expand the scope of network. Promote the pace of network to expand its scope. Spend more resources to build wireless access network and broadband access network, Informatization Microwave and satellite communications to improve the capacity of transmitting data, voice, images.

(2) To speed up the construction of geographic informatization system (GIS). And according to different specialty needs, building a shared database and special application database.

5. Conclusion

The rail transit construction informatization management system will promote the traditional organization structure reform to "flat". Thereby it improves the communication efficiency of involved parties in the rail transit construction projects and reduces the cost of communication to facilitate the management and coordination of the clients. But the implementation environment of informatization management system is not mature yet. Therefore, it is necessary to take measures from three aspects to promote the rail transit construction informatization management.

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