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General Planning Informatization Research Based on Whole Life Cycle of Hydropower Station For Basin Wide Hydropower Development Company

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Abstract: Along with the arrival of Chinese hydropower construction investment peak and the application of computer technology in the whole life cycle of hydropower station of every stage, isolated data appeared between different stages in the whole life cycle, as well as different professional module of the same stages. Based on the whole life cycle theory of hydropower station, overall planning informatization of basin wide hydropower development company was studied. The overall planning includes main information system modules of each stage of the whole life cycle of hydropower station, such as: basin wide or river planning stage, pre-feasibility study stage, feasibility study stage, bidding and construction stage, completion operating and maintenance stage and digitalization basin stage. Meanwhile, based on the transverse business sectors, management of comprehensive enterprise, hydropower station construction process, production operations, and function business modules of hydropower station was studied. After the implementation of the plan, whole process planning informatization is except to be unified, and a unified data model should be established. Finally, a new management model can be formed, the purpose of efficient management can be achieved.

Introduction

China hydropower station is in high-speed development, according to the division of 13 large sized hydropower bases, by 2010, 2015 and 2020, 35%, 55% and 70% must be reached respectively for whole exploitation degree of 13 large sized hydropower bases [1]. During the peak period of hydropower exploitation, the hydropower exploitation company have been established in each valley, for building hydropower stations to hydraulic resources exploitation, investing power station construction management, and operation management of built hydropower station. As the network and hardware equipment cost reduction, there are plenty of physical devices such as network, hardware equipment and the information security for each basin-wide exploitation company, subordinate hydraulic power plants and construction management agency. Currently, office automation system and financial system have been widely used, most of professional system have been used in the company. However, overall planning for hydropower exploitation company's whole business and trend of development are not exist. The implement of information system, data sharing between each business system are poor, business is weak synergy. And, the sequential of basin-wide hydropower exploitation lead to poor inheritance of data, which belong to different periods.

Based on the whole life cycle of hydropower station, unified planning for the entire process of informatization was proposed, by which, unity of data model was built up. On the basis of informatization overall planning obtained from basin-wide hydropower exploitation life cycle method, the informatization of entire process will be realized gradually, construction management mode “small companies, big supervision, infrastructure production of integration”, will be realized and efficient management will be achieved.

Whole Lifecycle Theory for Hydropower Station

The whole life cycle of hydropower station theory includes: river basin(river) planning, pre-feasibility study, feasibility study, bidding construction, completed and operating maintenance and the digital basin stage [2]. The informatization process of basin-wide hydropower exploitation company throughout each stage, information systems and information achievement of one stage is the basis of starting of informatization system in the next stage, and is the continuation life of previous data and process of data reconstruction and improvement. Specifically, for basin-wide hydropower exploitation company, it may begin from one of the stage of specific hydropower station project life cycle.

Research Contents

Individual basin and even a single hydroelectric project taking long period of time for exploitation, it's own development process is complicated, and with strongly boundary condition influence. Based on the whole life cycle of hydropower station, basin-wide hydropower exploitation company informatization overall planning contains long time span business and extremely wide information category.

A. Division According to Business Sector. Division of overall planning informatization according to business sector was shown in Tab.1.

1) Comprehensive management for river basin company: Enterprise portal module shows key information of enterprise. Administrative official documents is used to handle administrative office information. Human resources management module is applied for management of human resources and related information. Human resources information including organization management, staff basic information, salary management, insurance management, labor contract management, performance management, staff rewards and punishment management, recruitment management, training management, performance evaluation, and staff self-help[4]. Financial management module is applied for the financial and related information management. Financial information including: general ledger management, accounts payable, fixed assets, expense reimbursement, project accounting, finance management, the budget management, financial decision analysis[5]. Asset management information module is designed for related asset information management. The external interactive module manage information resources of company boundary conditions.

Tab.1 Division of whole planning informatization

Enterprise comprehensive management	Enterprise portal module
	Administrative documents module
	Human resources module
	Financial management module
	Assets management module
	Module for external interact
Management of hydroelectric station construction process	Design management module
	Electromechanical material module
	Construction management module
	Land requisition and resettlement module
	Investment management module
	Contract management module
	Schedule management module
	Quality management module
Management of hydroelectric station's production and operation	Production management module
	Equipment Management module
	Operation management module
	Material management module
	Technical management module
	Safety Management module

2) Hydroelectric station construction process management: Design management module is used for mutual information with design institute. Mechanical and electronic material management

module is applied for management of mechanical electrical equipment, steel, cement, oil and other large sums of construction materials. Construction management module realize the related information management of the construction. This module is applied for management of construction log, intermediate stage measurement and payment, change of the design during construction process and its influence, collaboration with other business.Resettlement management module is used for management of the land expropriation from reservoir and submerged region immigrants. Resettlement, file management, and showing and association these information in geographic information systems. Investment management module is used for statistical analysis information of investment as project completed. It can deal with investment estimation, approval and maintenance for Budgets, Statistics and modify Investment plan and Investment analysis. Contract management module is used to realize the information processing of contract execution from bidding documents writing to the basic information maintenance and change management during process of contract carried out. Progress management module is designed for realizing construction project schedule information processing. Quality management module used to realize the construction quality information processing [6].

3) Hydropower station production operation management: Production management module is used for management of running log, operation ticket, work-sheet, and the record of the experiment, the shift rotation information. Equipment management module is used to manage hydropower station equipment fixed assets information. Operation management module is appied for real-time processing of operation information, generating operation report. Material management module is used for management of the purchase order, Storage and maintenance, distributed material planning stock information, and generating reports. Technology management module is used to manage technology document related to power plant. Safety management module is applied for management of hydropower station security documents planing and emergency reserve material.

B. Division According to Whole Life Cycle Stages.Each stage data of whole life cycle stages constantly accumulation and ascension. As shown in Fig 1.

4) River basin (river) planning stage: Digitalization of data from investigation of the earth's surface and the local geology prospecting, that is digitalization and visualization of river basin (reach) the surface of hydrological, geological, weather, the humanities, the environment. Collecting the information of basin /river geography and topography and geology, hydrology and geographical, providing a convenient and effective analysis of data query method for basin (river) planning.

5) The pre-feasibility study stage: Realizing the three-dimension visualization of the hydro-junction, the visualization of geology, topography and landforms of dam area, helping exploitation company undergo the audit of authorities and analysis, and provide data base for the feasibility work in the next stage.

6) Feasibility study stage: The work of stage is collecting and analysis information which based on the river basin (reach) or part of the river natural topography and landforms, geology, hydrology etc, and the integration of hydro-junction information.

7) Bidding construction stage: The implementation of original topography ,landforms, geophysics digital, visual work, construction zone communication system built , public communication network access, and the engineering management information system.

8) Completion operating and maintenance stage: The hydropower station maintenance operation management, reservoir operation management, maintenance of hydro-junction building and power transactions etc.

9) Digitalization basin stage: The digital visualization and data mining analysis process of the basin topography, landforms, hydropower station, town in the basin, history culture etc.

C. Division According to System Implementation Process

Division according to system implementation process is shown in Fig.2.

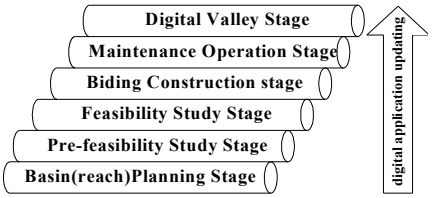

Fig.1 Data upgrading process

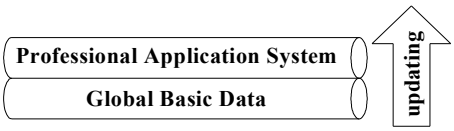

Fig.2 Division according to system implementation process

1) Global base data processing: Personnel database, financial foundation data dictionary, fixed assets data dictionary, spatial data.

2) Professional application system implementation: Human resource management, financial management, construction project management, electric power production operation management.

3) System operation, maintenance and upgrade: Unification of operation and maintenance scheme and the standard. Adjusting and upgrading the system for the business needs and software product upgrades.

The Outcome of The Study and Discussion

A. Overall Planning Based on The Business Process. Business process is the core of the management information system. With help of the overall planning based on the business process , requirements of the business can be satisfied. Overall planning for hydropower development is shown in Fig 3.

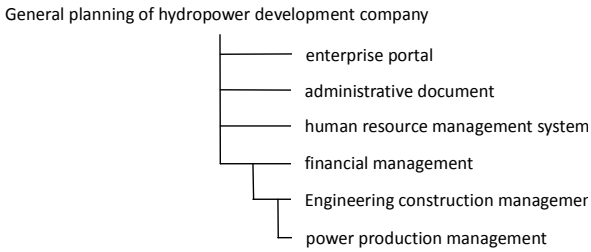

Fig.3 Overall planning for hydropower development

Construction of enterprise portal can collect and show all the company information, administrative document satisfies the company administrative information release and transfer. Human resources system and the financial management system are the foundation of basin-wide hydropower exploitation company initial construction and the daily operation management, it must be implemented earlier than the project management system and electric power production management system. For a single hydropower station project power generation must later than construction, therefore, project construction management system implementation must be earlier than electric power production management system, the data accumulated by the project construction management system services for power production management information system.

B. Overall Planning Based on The Data Process. Comprehensive enterprise management, construction project management, power plant production management, all have their own theme database, which provide the data service for each business application system, realize the logical relationship of each business module. It was shown in Fig. 4.

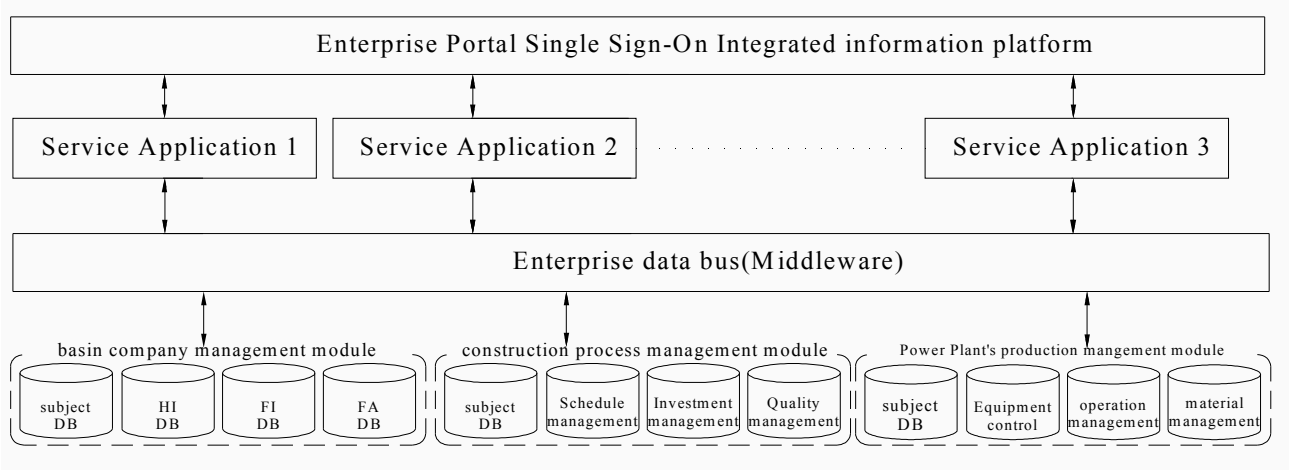

Fig.4 Enterprise portal/single sign-on integer information platform

C. Shortage And Improvement of The Planning

The basin-wide hydropower exploitation Company which is not in the same life cycle stage, meanwhile the actual level of each company informatization is different, all factors above lead planning condition data accumulation conditions to be inconsistent. Overall planning does not take the actual differences between the companies into account, Therefore, before planning forming, actual status of each company should be carefully analyzed, pre-stage data should be fully prepared and arranged, only by this, the consistently condition of the information system implementation and the company status in the whole life cycle stages can be available. In addition, the lack of separate planning for the enterprise standard data, the starting point and the foothold of informatization are realizing information sharing and cooperation between different business. Information sharing can't be achieved ,without standardization of data. Successful business corporation can't be available, even enterprise computer information system cannot be set up. Standardization of data is basis of construction of basin development company's informatization, it is factor which influents the success or failure of informatization directly. The system really play a proper role, only good management of data, making full use of data, uniqueness of the data, completeness, accuracy, betimes be guaranteed. Also, before complete planning, company should give full consideration to the data standard.

Conclusion

Based on the whole life cycle of hydropower station method, key point of Hydropower station informatization overall planning is the basic data collection of hydropower station in each stage of life cycle, Planning completion and information system project implement should according to different stages in hydroelectric project, and on the basis of meet the previous conditions, starting point should be chosen appropriate. Process informatization is associated with enterprise business constantly adjust and improve process. The powerful guarantee of the information system sustainable development is training professional talent team with computer technology.

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