

A CASE STUDY FOR INFORMATION MANAGEMENT SYSTEM IN CONSTRUCTION ENTERPRISES

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Abstract: Comparing with the developed countries, the information technology for architectural construction enterprises in China is relatively backward. However, with the economic globalization and the accelerated pace of modernization, as well as the China's reform and opening-up, the domestic market is increasingly global. The increasing opportunities bring stronger challenges and keener competition, which makes information technology of architectural construction enterprises more necessary. The article takes enterprise A as an example, discusses the Building Programme in Chinese construction enterprise information management systems from the view of integrated management system, control project costs, project fine management of the whole process and intelligent business management, etc. The article is based on the characteristics of Chinese construction enterprises and provides reference experience for the same type construction enterprise.

1 INTRODUCTION

Comparing with the developed countries, the information technology for architectural construction enterprises in China is relatively backward. However, with the economic globalization and the accelerated pace of modernization, as well as the China's reform and opening-up, the domestic market is increasingly global. The increasing opportunities bring stronger challenges and keener competition, which makes information technology more necessary for architectural construction enterprises. Information technology is significant useful both in the project planning and management. More than 90% of foreign architectural construction companies have adopted software to manage projects, while the number in our country is less than 10%. The gap reflects the potential. In addition, most construction companies are operating collectivized. The diversified businesses of a large amount of branches and subsidiaries have great demand in enterprise information technology, which is most manifest in the following aspects:

Business Development: Business development requires information support of external market research and industry analysis. Additions of new business units need more open interfaces and more

scalability in future IT architecture, as well as enterprise information infrastructure, which can enable service-oriented and flexible system. So that enterprises can adjust the information management architecture flexible and timely as soon as their business organizations changed.

Business Integration: Project management, a business that needs major support in IT systems, is still the core business segments. Synergy of each business unit is currently mainly reflected in group control level such as the strategic positioning. There are high demands between the business units to integrate their business information.

Resource Allocation: The resource allocation can realize the standardization of enterprise infrastructure information and unified management, support information sharing and resource optimization. Currently, the business forms of most groups are multi-site multi-service and multi-organization and need to realize centralized management by information technology.

Strategy Implementation: based on the finance and business all-in-one, integration of financial and business can help policy making group to achieve macro-control of the business. Through both internal and external information analysis to achieve decision support and find the deviations in strategy implementation and opportunities for improvement.

These requirements determine that the information management more necessary in construction enterprises and construction enterprises can benefit more than other industries. For these reasons, the paper took a construction enterprise as an example to do tracked research and case study in its information management system.

Construction enterprise A, whose company registered capital is 305.8 million Yuan, owned over 3,000 staffs, including 1593 that have economic and technical titles. The company possesses a qualification of contracting on premium construction, qualifications of contracting on first-class fire facility projects, electrical and mechanical equipment installation, steel structure works, lifting equipment installation and elevator installation, qualifications of contracting on first-class intelligent building engineering, intelligent building design and curtain wall design, qualifications of contracting on second-class municipal public works and water conservancy and hydroelectric power project construction.

2 MOTIVATION OF INFORMATION TECHNOLOGY IN CONSTRUCTION ENTERPRISE

In the enterprise development process, decision-making group in construction enterprise has a growing awareness: the application of modern network information management technology is an effective way to improve the management level, strengthen capabilities of rapid response and control and enhance the core competitiveness.

2.1 Fine Management

Construction enterprise A reformed in October 2000 and output value in that year is 820 million yuan. In the end of the first round of contract, the final output value is 4.402 billion yuan in 2003, while in the end of the second round in 2006, the output value is 9.7 billion. With rapid development, management bottlenecks are becoming apparent. Construction industry needs construction qualifications and safe construction permits. The industry is over a broad area, and a lot of works need to be done manually by workers. So it is influenced a lot by human factors.

In this case, the original flat management model began to be inadequate. Decision-making group in construction enterprise A determined to introduce

the "fine management" concept. Through the construction of enterprise information platform, the management can be traced back, can be analyzed and can be trusted to achieve the fine management purpose.

2.2 Standardization

Construction enterprises A, the first batch of pilot units of a quality assurance system in Jiangsu Province, began implementing the ISO9002 quality management system standard in 1996. After an eighteen months test run, enterprises A obtained a certificate issued by China Quality Association in September 1997. Then in early 2000 enterprises A began implementing the ISO14001 environmental management standards and received a certificate issued by China Quality Association in December. With the generation of ISO9000: 2000 version standards and occupational safety and health management system certification gradual development, the fourth company of Nantong construction integrated the quality management system, the environmental management system and the occupational safety and health management system to form a management system using share factors.

Integrated management system in construction enterprise A includes 40 management procedures such as indicators and management program, management review, human resources, construction machinery, construction design, contract review, purchasing control, construction control, site safety, nonconforming product control, risk assessment and control.

The implementation of the integrated management system is conducive to resource allocation, reduce management costs of the organization, and improve operating efficiency of construction enterprise A. However, in actual implementation, "mismatch" phenomenon also exposed in some the projects between the regulation and the implementation: the management system made by the group not well implemented in subordinate units and Department of projects.

Through the construction of the enterprise information platform, curing the management process and management system, standardization of business management is achieved and overall management in construction enterprise A is improved.

3 INFORMATION TECHNOLOGY IN CONSTRUCTION ENTERPRISE A

In 2008, construction enterprises A, according to the Ministry of Construction "premium quality evaluation standards for enterprise information technology" and its own management requirements, cooperate with UFIDA and establish an information sharing network management system linked corporate headquarters, subsidiaries, divisions, Department of the Agency and project. The system focus on the core business and achieve the implementing of information technology in the overall management process.

Construction company A now has formed an informational system: "the two platforms and four applications". The system applied in more than 100 projects under the Ministry. The two platforms are hardware and software platform and the four applications include office automation, human resources management, financial management and project management.

Hardware platform: the work is the foundation of enterprise information services, hardware, networking, and security.

Software platform: It refers to UAP platform of UFIDA. It is to achieve integration of financial service applications.

Office automation: include information dissemination, document management, project management, task management, meeting management, vehicle management, office supplies management and other functions. It provides unified portal, authentication, trust between systems, authorization function for various applications.

Human Resource Management: A full-cycle management from the recruitment, entry, changes to the resignation or retirement, including human resource planning, reporting, decision analysis, labor cost management, organizational management, information management, personnel changes management, contract management, remuneration and benefits management, time management, training management, recruitment management, policies and systems management, performance management and self-help applications.

Financial Management: including financial accounting and financial management, to achieve one-account in the whole group. Financial accounting system includes general ledger, cash banking, receivable management, payable management, fixed assets, inventory accounting and reporting. Financial management system includes

capital budgeting, capital settlement, credit management, interest management, integrated credit, online banking, bill Management and financial monitoring.

Integrated Project Management: Core of management information technology in construction enterprises A. It covers the project life cycle, integrating the various functions of project management. It is a fine management of the project. It Includes bid management, contract management, revenue management, cost management, materials management, mechanical management, schedule management, quality management, security management, completion management and risk management.

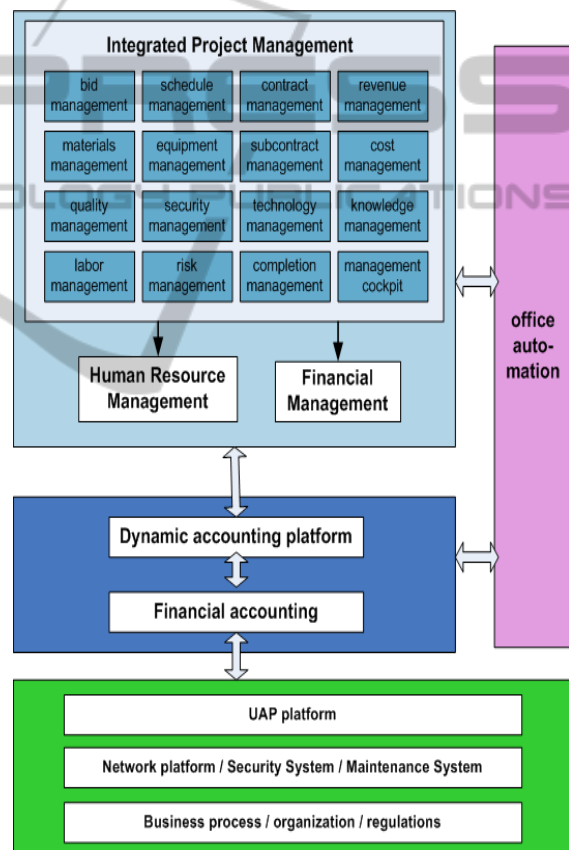


Figure 1: Information technology deployment of construction enterprises A.

4 INFORMATION TECHNOLOGY ENHANCED MANAGEMENT OF THE FOURTH COMPANY OF NANTONG CONSTRUCTION

Information technology prompted the execution of "Integrated Management System" in subsidiaries and ministry of projects. It decreased the project costs, improved project profitability and improved the project refined and intelligent management.

4.1 Implementation of the "Integrated Management System"

By introducing the advanced information technology, construction enterprises A formed an "electronic edition" of the integrated management system. A whole project management process can be divided into four stages: project identification, project planning, project implementation and management review. The four stages cover 16 functional modules: bid management, contract management, cost management, revenue management, subcontract management, expenditure management, materials management, equipment management, schedule management, quality management, security management, new technology management, completion management and risk management.

4.2 Project Costs Control

Construction increases at an annual rate of 12.9%, accounting for 6-7% of total GDP, creating 300 billion dollars foreign exchange earnings for our country every year. Although the construction industry is developing rapidly, there are discordant problems, concentrated expression in the irrational industrial structure, irrational layout and low profits. Construction industry profit, which is 2%, is the second lowest in the industry. The assets and liabilities rates are 65%, ranked first in the second industry. Reduce costs and increase profits have become core tasks for the construction enterprises survival and development in the highly competitive market.

In the long term of the project management process, construction enterprise A accumulated effective experiences, summarized as "do after count, process control, statistical analysis". Combined with information technology, supervise, regulate and restrict the consumption of human

resources, material resources and cost in production and operation, and promptly correct the deviation, control the production costs within the planned range to ensure the cost goals, improve project management level and market competitiveness.

4.3 Whole Process of Project Fine Management

4.3.1 Bidding Management

Collect market information and divide the projects into level one projects and level two projects according to the features then manage the bidding at different levels.

Level two projects usually refer to projects have unit project cost or equipment installation cost ≥ 5 million yuan, or number of layers ≥ 30 , or floor area $\geq 50,000$ square meters or industrial buildings span > 30 meters, as well as customer requirements or projects have significant impact on the company and projects organize and bid by the Group. Level two projects refer to projects whose project departments set up by the regional headquarters / branch office.

The tender documents assess at the tender stage, and the bidding documents assess at the bidding stage. Record the project bid in an effort to gain experience for future bids.

4.3.2 Contract Management

Contract review includes assessment of the draft contract at signing stage and assessment of the modification at the implementation stage. The contents of the contract will be disclosed to the project manager and then project manager will disclose it to the others. Register the contract basic information and details, maintain contract content, save the electronic contract documents, establish a complete accounting of contracts and can be retrieved by the conditions.

4.3.3 Cost Management

Cost management is the core of the project management system. For a long time, the fourth company of Nanchang construction accumulated management experience in the process of construction as "do after count, process control, statistical analysis" and cost management as "separate volume and price, the volume control the main".

Make a budget and material consumption plan in the cost planning process. Make actual cost sum up

in the project process, form a management system can analyze and control cost to ensure that the project achieve the gross margin and lower the management expense ratio.

The system can achieve multi-dimensional cost management.

Determine the budget cost by calculating. Determine the actual cost by accounting on the expense. Compare the budget cost and the actual cost to make comparative analysis.

Use numerical amount software to determine the total consumption of primary materials. Compare it with the actual consumption. Analyze the differences between the budget and the actual consumption.

In addition, further fine management about project costs and material consumption can be achieved according to sub-segment costs.

Cost management is to manage cost through the business. That is to say, through the materials purchase, machinery leasing, sub-contract and sub-settlement to control the actual business and improve the management level.

4.3.4 Revenue Management

Revenue management includes the initial revenue in the bid contract, rewards and punishment records result from the project implementation changes and records on the measurement and payment.

Revenue management can provide records of quantities, every change, details on the measurement and revenue to raise the fine level of revenue management.

4.3.5 Schedule Management

It focus on the time planning, control and management. Decompose the sub-segments of the project, make general plan for project and process. Then make the annual plan or monthly plan according to the general plan. The network schedule will display through bar chart, network diagrams and other tools. Record and adjust the progress of the project in the implementation progress of the projects and compared it with the original schedule to control project schedule risk and the actual progress of the project.

4.3.6 Materials Management

Material cost is the largest share of project cost. So material management is significant to achieve cost targets.

The material management aims to achieve a total control plan, monthly control plan, requiring plan, procurement contract, purchase orders, standardized storage. It includes the materials consumption management and material circulating management.

Manage the material storage, send, receive and inventory at the project level. Generate material statistics accounting to provide a basis for project cost accounting.

Manage basic work such as materials classification, coding and suppliers at the corporate level. Monitor the materials purchase, price analysis and material consumption and approval the processes. Make summary statistics of purchase, consumption and inventory.

4.3.7 Subcontract Management

Including labour subcontract and professional subcontract.

Achieve the sub-contract management system. The system should register basic sub-contract information, manage the sub-contract contract content, maintain the electronic contract documents, record the payments for approval of the sub-contract project and establish a complete sub-contract accounting which can be search on conditions.

Assess the compliance performance of suppliers and establish a database of qualified subcontractors and blacklist. All the information will be share in the whole group.

4.3.8 Device Management

Use uniform code for device which can be classified according to equipment. Register the equipments in the system and establish equipment Accounting. The department of the project makes the equipment plans and reports it to the department of equipment management for approval. Department of equipment management allocates the equipment device according to the situation of projects and account equipment rental costs of each project according to the provision of the company (including the rent and leased). Department of equipment management and department of the project should record equipment repair and maintenance condition, as well as information of spare parts and the device hazard information. The fourth company of Nanchang construction generated statistical analysis reports on the classification of equipment, use, distribution and cost. The reports provide a database for the fourth company of Nanchang construction to plan, acquisition and deployment. Moreover, it can

improve the equipment capacity, equipment efficiency and input-output efficiency.

4.3.9 Quality Management

Project quality managers input the quality control and plan through the system. And report the quality inspection quality accidents, quality treatment, quality rectification and other records on time, and reporting on time, business managers can find quality problems and monitor the management through the system.

4.3.10 Security Management

Through security Management, company managers can easily check the project safety organization. The security managers input the safety objectives into the system and real-time report the It includes security expenses, security risks, security incidents, security training, security assessment sub-units and personnel record. Business managers can find security problems and monitor the management through the system.

4.3.11 Completion Management

The completion management records completed cases and classifies the completion data.

4.3.12 Risk Management

Generate automatic warning according to risk parameter and business data in project Implementation. The warning includes progress management risk warning, project contract change risk warning, contract payment early warning, cost implementation risk warning, equipment inspection warning and other functions. It supports emails, short messages and other warning means.

4.4 Enterprise Intelligent Management

“Management cockpit” is built to meet needs of the decision-making group, management group and business management group and to provide timely, accurate and useful decision support information for the fourth company of Nantong Construction. The “management cockpit” can show the situation of the company's overall operations, graphical output the business lines of each sub-aperture data, compare and analyze by using Group Control desktop, company control desktop, project supervision desktop.

“Management cockpit” is divided into four levels of management structure: Nantong Construction Group headquarters, regional headquarters, construction and installation branch offices and project management. It also provides corresponding multi-company, multi-project, project level statistical analysis reports, establish a complete management system structure.

Real-time centralized monitoring of major economic indicators: complete data extraction of sub-units, calculate and display on the decision analysis desktop timely and accurate so that the leaders can monitor the economic performance indicators of subordinate units.

Integrate system data from each module, such as tender, project basic files, contracts, revenue, subcontracts, payment, cost, quality, and safety. Add professional analysis and use unified view of operations to meet the needs of senior leadership;

Customize the desktop: strip the desktop show with a report. Realize the dynamic assembly business show and analysis of these data to improve the decision-making process of project management and improve operational efficiency.

5 CONCLUSIONS

In order to achieve the overall goal of information technology in enterprises, there is a clearly define in standards of A: the implementation of enterprise information technology adopts the institution: "number one responsibility". That is to say, general manager is the person responsible for information technology in company. Top leaders in all branches, the Agency, project management companies are the person responsible for information technology in their units. The company also set up a leading group of enterprise information technology and business Information Office. Also, every unit has full-time information officer in charge of information work of the unit.

In order to implement the information technology into practice, enterprise A institutionalize the information technology such as established a monthly reporting system, electronic document management practice, both inside and outside consultation, exchange control, staff training, reward and punishment evaluation management procedures, etc.

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