

Research and Development and Application of Information Management System for Tendering and Procurement in Universities

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Abstract

With the development and expansion of universities, higher demand in office supplies, constructions, and services lead to more procurements, together with high requirements on tendering and procurement. In order to solve the problems of increasing number of applications, process being too complex and low efficiency in the tendering and procurement of colleges and universities, a design model and overall structure of a workflow-based university procurement information management system is proposed here, and key technologies for the tendering and procurement process of colleges and universities are developed. Integration of procurement budgeting, planning, tasks design, execution, contracts, acceptance check, and payment is achieved. Such system is proved to provide effective support for tendering and procurement and improvement in management efficiency through the practical application of such system in the domestic universities.

Key words: Procurement in universities; Management system; Research and development and application

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1. BACKGROUND

Due to the rapid development of domestic college education and with the expansion of teaching, scientific research, and basic construction, the three major types of procurement projects, office supplies, constructions and services, have increased every year. According to the requirements of government procurement and the internal control management of universities, tendering and procurement include a series of processes such as procurement budgeting, procurement planning, procurement tasks design, procurement execution, procurement contracts, procurement acceptance check, procurement payment, and procurement assets. The units and departments involved in the procurement process include the purchase units, their departments, the financial departments, the administration department, the procurement execution department, as well as a number of departments and personnel such as entrusted agencies, suppliers and so on. Methods applied in the past have difficulties adapting to the needs of multi-campus and multi-department, internal and external collaborative procurement management, and it is difficult to control the entire tendering and procurement process and the risks of integrity internally. The older methods fail to provide the procurement in universities with "only one" service. It fails to improve the efficiency of tendering and procurement and fails to create an open and fair environment. To this end, tendering and procurement information management system in the universities is developed, a joint framework of information technology of internet and tendering and procurement is used to solve the problems encountered by universities in the traditional tendering and procurement work and to improve the efficiency.

2. GOALS

The construction of the university procurement information management system is designed to achieve the following goals:

According to the requirements of government tendering and procurement in colleges and universities, this system aims to build an information management platform that integrates office supplies, constructions and services, meets the needs of teaching, scientific research, infrastructure, logistics, and administrative management of the universities, and includes tendering and procurement, which were distributed among departments based on functions in the past, in the new information management platform. It unifies the administrative management and improves the macro management capability and efficiency of the tendering and procurement management.

Tendering and procurement is a relatively policy-oriented job. It establishes a full-cycle internal control management system for tendering and procurement, which can effectively control and track the entire process of the procurement project and improve the capacity of key business processes and internal control management. It integrates the stiffness of information-based processes into business management, standardizes the business processes, and improves risk control capabilities.

It serves the teaching, scientific research and administrative management of colleges and universities, providing tendering and procurement information management system that is simple, convenient, and with information security. It also provides faculty and staff with online tendering and procurement tools, taking advantages of the internet and avoiding manual process.

3. TENDERING AND PROCUREMENT PROCESS

Tendering and procurement management involves the procurement of different items, departments, funding sources, quota standards, procurement methods, and agents. The business processes are relatively complex. On the one hand, it needs to meet the internal control and management requirements of tendering and procurement; on the other hand, it must improve the efficiency of tendering and procurement through research and analysis, using a full-cycle management model, analysis and design system. The entire tendering and procurement business is divided into six functional processes: procurement planning, procurement tasks design, procurement execution, procurement contracts, procurement acceptance check, and procurement payment.

Procurement planning process: The purchaser first applies for a purchase and forms a planning arrangement that has been reviewed and approved. Procurement application includes the list of items, detailed price, and relevant attachments. Such procurement includes

physical goods, engineering (non-construction projects) and services, the procurement plan workflow approval process and multi-funding procurement, and query of the procurement plan and execution status of different authorized users.

Procurement task-design process: It includes the forming of the tasks after the procurement plan is classified and accepted, and approved by the procurement management department, the clarification of procurement organization form and method, and the execution of the tasks. It includes functions of classifying the purchasing plan, creating, approving, releasing and tracking tasks. In addition, it includes workflow task approval process.

Procurement execution process: The tendering and procurement execution agency receives the procurement execution tasks assigned by the procurement office and assigns them to the corresponding procurement executors according to the procurement method. The procurement executors can select different procurement execution methods according to the specific requirements of procurement, including entrusting third-party tender procurement, tendering and procurement by the school, centralized government procurement, departmental purchase and individual's own purchase, etc., issuing tendering and procurement announcements, filing procurement documents, tendering evaluation and transaction announcement, etc., and filing the transaction results for registration.

Procurement contract process: According to the procurement quota standards and the type of procurement business, different contract management methods are adopted, including two types of contract approval registration and contract record registration. The contract approval process includes the buyer's contract drafting, review, approval (conference review), contract enquiry, and copying of the original contract. The record registration process is scanned and registered by the purchaser of the original contract.

Procurement acceptance and check process: According to the school contract acceptance management method. Two methods, project acceptance and simple acceptance, are adopted. The project acceptance and check process is initiated by the purchaser, which is reviewed by the department, administrative department, and tendering and procurement management department. After the process is completed, the acceptance result is registered. The "Project Acceptance Registration Form" is automatically generated and the copy of the original document is registered. For a simple acceptance, the acceptance unit performs a simple acceptance of the acceptance results and scans the original documents for registration.

Procurement payment process: After the acceptance and check process is finished, the purchaser files a payment application and sends all pre-payment information (contracts and invoices) to the procurement management department. After confirming the payment,

the purchase payment application form is filed, and the original document is scanned for record. For the first payment, a purchase payment application can be made directly in the application of pre-paid items. Later payments can be applied with applications of project acceptance.

4. RESEARCH FOR KEY TECHNOLOGY

Technology on the workflow. The workflow model provided by the WPMC (Workflow Management Coalition) is a web application-based workflow system which is designed and developed by using a multi-layer architecture technology based on the architecture and components of “.NET”. The core workflow engine is packaged in the form of components, separated from the database and user interface, which is convenient for system maintenance and interconnection with other internal systems. The workflow engine is composed of an interface and internal core processing. In the internal core processing, technologies such as caching and multi-threading are used to improve system performance. In the meanwhile, the system provides a complete secondary development of Application Programming Interface (API), which can easily be used for other purposes according to the rapid development of various applications of the system.

Technology of data acquisition and exchange. In order to support data exchange among heterogeneous platforms and heterogeneous systems, eXtensible Markup Language (XML)-based data exchange technology is used to achieve data exchange between different application systems, and there is a variety of information sharing with the school network center. During the data processing process, it is not only necessary to complete data exchange and automatic business processing among homogeneous systems, but also to achieve interconnection and interoperability on heterogeneous platforms and in different networks, including the interface of school budget management system, asset management system, and electronic monitoring system.

Unified user authentication. It integrates with the school's existing identity verification platform and the user authentication. A single sign-on interface is implemented. After staff logging onto the unified identity authentication platform, they can access the system through the built-in “tendering and procurement management system” directly.

Internal control technology. According to the workflow procedures, it configures tendering and procurement internal control nodes and rules, uses the workflow engine to control node status, operating behavior specifications, time limits, funds and procedures, etc., and issues warning signals when abnormal behaviors are detected for prevention and control.

Data security. Since the university's tendering and procurement management system runs on the school's internal network, it uses internal and external network isolation technology to ensure system and data security. The use of regular data backup and self-service recovery technology under abnormal conditions ensures the security of tendering and procurement data to the greatest extent and ensures the security of data storage and access.

Technology of access control. It is actually a technology based on users and roles, combined with permission configuration technology, to manage and control the system's function set and data boundary set, in order to control the function permissions and data for different users when accessing platform functions, for the purpose of limiting operations and limiting access. Specific functions include function configuration management, organization management, external organization management, user account management, authority management, data management, workflow management, node configuration management, access log, identity identification, and so on. Various levels of access control are achieved through a hierarchical account and permission configuration system.

5. REALIZATION OF SYSTEM

Realization of an integrated management. The tendering and procurement information management system adopts integrated design and implementation and integrates the school's decentralized procurement framework into a unified platform to carry out various school procurement activities, including tendering and procurement, contract procurement, inquiry procurement and self-procurement. The integration includes: first, the integration of procurement of office supplies, engineering and services; second, the integration of decentralized procurement of various departments; and last, the integration of tendering and procurement data.

Realization of a full-cycle management. In accordance with the tendering and procurement management process, the entire process of procurement budget, procurement plan, procurement task, procurement execution, procurement contract, procurement acceptance and check, procurement payment, and procurement assets can be managed on the same platform.

Realization of an internal control management. Based on the establishment of the tendering and procurement information management system, through the workflow and process control technology, it configures the tendering and procurement internal control events, processes and nodes, collects dynamic data during the process, monitors the trajectory of the internal control nodes in real time, and detects abnormal activities and sends out early warning signals.

Realization of the information function of tendering and procurement. In accordance with the requirements of standardized tendering and procurement management, a relatively complete tendering and procurement information management system has been developed to include eight major functions including procurement budget, procurement plan, procurement task, procurement execution, procurement contract, procurement acceptance and check, procurement payment, and procurement assets, as well as the internal system management and other management system functions.

Realization of the implement system infrastructure. Under the environment of Microsoft Windows Server 2010 64-bit operating system, MS SQL Server 2012 database management system, and Web server using IIS, the browser and server (B/S) architecture is used to develop the information management system.

CONCLUSION

The research and development of the tendering and procurement information management system, on the one hand, solves the problems of networking and informationization of the tendering procurement process in universities, making the tendering and procurement management process and operation links very convenient to be presented on the flowchart, so that process can be monitored and traced back, improving the efficiency of

tendering and procurement management; on the other hand, it is convenient for teachers and staff to serve the school for the purpose of teaching, scientific research, and administration, and achieves the goal of “only one” service. It strengthens the management of internal control of tendering and procurement in schools, standardizes the behavior of tendering and procurement management, reduces the risk of corruption, promotes the healthy development of tendering and procurement, and creates a fair, just and open social environment for tendering and procurement.

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