Research on the Construction of Internal Control Management System with Geoscience Documentation Center.CGS as an Example

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Abstract. With the continuous development of big technology and big data, the demand for management informatization is constantly increasing. The complexity, convenience, and efficiency of management affairs have led to an increasing demand for risk prevention and control. In order to enhance the internal risk prevention and control capabilities of the unit, potential hazards are minimized and controlled as much as possible in advance. Therefore, we have built a set of internal management control systems suitable for public institutions. The system designed in this article is built using a platform+component (component) design approach, developed based on the JAVA architecture and adopting a centralized system structure to achieve process oriented internal control management in public institutions, achieve full process control of internal finance and affairs, change the situation of segmented management of various economic activities, information segmentation, and information silos, and thus improve the level and efficiency of unit management.All links are traceable, monitored, and have automatic risk warning, achieving intelligent integrated management.

Keywords: Internal control; internal control system; Management System.

1 Introduction

Under the background of the new period, public institutions bear the responsibility of public service, and their work efficiency is closely related to internal control. Establishing and perfecting the internal control management system of public institutions will help the smooth implementation of internal control work and give full play to the role of internal control. On this basis, public institutions can also combine the problems existing in the internal control work, take targeted and effective measures, build a set of effective internal control system within the unit, improve the financial internal control system, standardize the control activities of the unit, further strengthen the awareness of internal control, create a good internal control environment, continuously improve the financial internal control level and public service ability of China's public institutions, give full play to its social functions, and enhance social benefits, ensure the effective establishment and smooth operation of the internal control system, and lay the foundation for the smooth development of the business of the institution.Create a good internal control environment, continuously improve the level of financial internal control and public service capabilities of our institutions, give full play to

IEDM 2024, February 23-25, Kuala Lumpur, Malaysia

DOI 10.4108/eai.23-2-2024.2345907

their social functions, enhance social benefits, ensure the effective establishment and smooth operation of the internal control system, and lay the foundation for the smooth development of the business of institutions.[1]

In recent years, the continuous development of big data and intelligent technology has brought opportunities and challenges to the internal control system, thereby helping to innovate the internal power system. Compared with traditional internal control, internal control in the context of big data can manage enterprises more efficiently. Internal control makes information electronic, methods intelligent, and technology innovative. In terms of information communication, Zhongqiong Han (2018) proposed that in the process of enterprise operation, the dissemination of information largely depends on internal control, and big data can help enterprises achieve real-time communication, making enterprise management more efficient and intelligent.[2]In terms of risk management, internal control under big data can make the dynamic risk model of enterprises more accurate and predict with higher accuracy. In terms of controlling the environment, Wang Hongmei and Qiang Gu (2018) believe that the internal control environment of enterprises under big data is more reliable because information systems are transparent, shared, and less prone to fraud. From the perspective of control and supervision, as enterprises can timely collect a large amount of data and information from internal information platforms, external Internet of Things, and Internet of Things, on the one hand, enterprises can timely evaluate internal controls and carry out supervision; On the other hand, big data can also provide assistance for comprehensive internal control evaluation and supervision.[3]Hongmei Sun and Yujie Lei (2019) believe that the arrival of the era of big data and artificial intelligence has led to the emergence of emerging information technologies such as accounting cloud computing platforms, financial sharing centers, big data internal control 3.0 technology, financial robots, blockchain, and risk warning technology. While bringing efficiency and convenience to enterprises, it has also triggered potential internal control risks.[4]Jiarong Dou and Zhaoxue Huang(2022) proposed internal control and prevention measures based on artificial intelligence, such as strengthening data security awareness and preventing information leakage. Enterprise internal control should not overly rely on artificial intelligence for data control, but reduce attention to management personnel, improve management mechanisms, and focus on daily reviews.[5]

The theory of internal control comes from the United States, mainly to achieve financial internal control, and then with the implementation of relevant documents and reports, the scope of internal control continues to expand, has now developed to all walks of life. Internal control informatization is an important part of the internal control system, which provides realistic conditions for the landing of the internal control system. Because of the good theoretical basis and mature technical conditions, foreign countries started the construction of internal control information system earlier, and the construction of foreign internal control management information system mainly adopts advanced technology and methods to realize, especially the new methods in the management field are embedded in the internal control system, such as value chain, workflow and other concepts for information realization, which is different from the traditional office management system, which emphasizes the process of system business processing more, through the prediction of enterprise management risk points, the business process is solidified and monitored. [6][7] It has been popularized and applied in China since the 1990s. The internal control system of enterprises is the need of the development of fine management in all walks of life and the product of enterprise

development. Internal control management has laid a solid foundation for the modern enterprise management system. [8]

The U.S. Auditing Standards Board (ASB)(1972) proposed that internal control is the organization, plan, procedure and method of various constraints and adjustments implemented within the unit in order to improve operational efficiency, obtain and use various resources fully and effectively, and achieve established management objectives under certain circumstances.

In June 2008, the Ministry of Finance, the National Audit Office, the China Banking Regulatory Commission and other five ministries jointly promulgated the Basic Standards for Enterprise Internal Control and began the construction of my country's internal control system; the Ministry of Finance mentioned that internal control refers to the prevention and control of the risks of economic activities by formulating systems, implementing measures and implementing procedures in order to achieve control objectives.(Practical Operation Model of Internal Control Norms in Administrative Institutions, 2012)

Here there is the meaning of distinguishing between large and small internal controls. Large internal control refers to the internal control norms should be the unit's overall internal control, full internal control, should cover all the management activities of administrative institutions, a mutual restriction and supervision of the business organization form and division of responsibilities system.(Practical Operation Model of Internal Control Norms in Administrative Institutions,2015)Large internal control emphasizes "all management activities of the unit", including daily office, project management, financial management, personnel management, equipment management, party affairs management, discipline inspection management, safety management, information management and so on.

Small internal control is an economic-related activity that prevents and controls the risks of economic activities. Specifically, it involves budget business, revenue and expenditure business, asset management, government procurement, construction projects, contract management, etc.

The University of Oregon (2016) states that internal controls are designed to effect reasonable assurance in the organization in order to meet its mission, promotes performance leading to effective accomplishment of objectives and goals, safeguards assets, provides accurate and reliable financial record, promotes operational economy and efficiency, and promotes adherence to applicable laws, regulations and prescribed management policies and practices. It further opines that internal control help ensure that necessary actions are taken to address risks while achieving the institution’s objectives. [9]

The Geoscience Documentation Center of the China Geological Survey (hereinafter referred to as the Geoscience Documentation Center.CGS) responds to the requirements of the Ministry of Natural Resources and the China Geological Survey Bureau, and combines the feedback from inspections, audits, financial inspections, and special rectifications to sort out and summarize the risk points of clean government. Information technology means, gradually improve various rules and regulations, establish and improve internal control management information systems, thereby reducing risks and ensuring the safety and stability of the center's business.

2 Why should build internal control system

2.1 The internal control system is the demand of system landing

The construction of the internal control system, that is, the use of information technology to embed the internal control system into the information system, can realize the normalization and proceduralization of the internal control management of the unit, and change the management of various economic activities in blocks, information segmentation and information "islands" The situation, thereby improving the management level and management efficiency of the unit.

2.2 The internal control system is the requirement of organizational risk control

There are hidden risks in enterprises or institutions, and there are human factors in actual operators, such as unfamiliar systems and unclear processes, resulting in unnecessary errors, such as reimbursement standards exceeding the standard, untimely implementation of contracts found in the audit process, unpaid payments, unpaid quality assurance funds, etc., timely remind the handling personnel in the internal control system, so as to reduce the error rate. The system is configured with the necessary standards, such as travel standards, to promptly remind the operator if they exceed the standard. The construction of the internal control system, so that the process standardization, closed-loop management, the risk control to the smallest possible. The internal management system of the unit is not perfect, and the construction of the internal control system can find the problems of lack of system and unreasonable process in time, so as to constantly improve the management system and avoid risks as much as possible.

Shanmugam (2013)[10] argues that due to their inherent limitations, small and medium-sized enterprises struggle to detect fraudulent behaviors among employees.Therefore, when devising comprehensive internal control systems, companies must prioritize monitoring employee conduct to mitigate the potential risks of fraud. Ifeoma Udeh (2019)[11] also arrives at a similar research conclusion. Berlingieri (2015)[12] suggests that the optimization of internal controls primarily involves increasing management's attention to relevant areas to better leverage their effectiveness.Mahtani (2018)[13], through a study of factors contributing to risks in business operations, evaluates and analyzes enterprise risks based on the degree of impact.

2.3 The internal control management system is the need for convenient management

Internal control management can make the operation of each link within the enterprise can be well connected, and achieve the best state, so as to improve the core competitiveness of the enterprise, and at the same time make the enterprise achieve the best effect in all aspects, and cooperate closely with each other, play a coordination effect, but also avoid short-term behavior. The effective construction and operation of internal control management and its role will provide reference for the subsequent system construction, innovate the management mechanism, and promote the efficient operation of public institutions.

3 How is the internal management control system established

3.1 The guiding ideology for establishing an internal control management system

According to the Ministry of Finance on the issuance of the Administrative Institutions Internal Control Standards (Trial) Notice (finance and accounting[2012] No. 21) and the Administrative Institutions Internal Control Report Management System (Trial) Notice (finance and accounting[2017] No.1)and other regulations, establish a "decision-implementation-supervision" closed-loop management mechanism, reasonably ensure that the economic activities and other business areas of the Geoscience Documentation Center.CGS are legal and compliant, asset security and effective use, financial information is true and complete, effectively prevent fraud and corruption, and improve work efficiency and effectiveness. We will build an internal control system with consistent powers and responsibilities, effective checks and balances, smooth operation, strong implementation and scientific management, so as to achieve the comprehensive internal control goal of "full coverage of the unit, systematic internal control, perfect measures and more effective implementation", and further improve the management level.[6]

3.2 Principles to Follow in Establishing Internal Control System

*The principle of comprehensiveness.*Internal control runs through the decision-making, implementation and supervision of the economic activities and other business areas of the Geoscience Documentation Center.CGS, realizing the overall control of economic activities and other business areas.

*Principle of Importance.*On the basis of comprehensive control, focus on the important economic activities and other business areas of the Geoscience Documentation Center.CGS and its expected major risks.

*The principle of checks and balances.*In the Geoscience Documentation Center.CGS internal department management, division of responsibilities, business processes and other aspects of the formation of mutual constraints and mutual supervision.

*The principle of adaptability.*In line with the relevant provisions of the state and the actual situation of the Geoscience Documentation Center.CGS, and with the changes in the external environment, the adjustment of internal economic activities and new management requirements, constantly revised and improved.

*The principle of problem orientation.*In response to the weak links and risk hazards in the internal management of the Geoscience Documentation Center.CGS, combined with the rectification of problems discovered through inspections, audits, and internal audits, we will focus on strengthening risk prevention and control in key areas and positions such as budget, revenue and expenditure, government procurement, assets, contracts, and projects, reasonably allocate rights and responsibilities, refine the process of power operation, clarify key control nodes and risk assessment requirements, and improve the pertinence and effectiveness of internal control.

4 On the Sequential Construction of Internal Control System of Geoscience Document Center.CGS

4.1 The construction of internal control to achieve closed-loop management

The construction of internal control management system relies on the internal system of the unit. Various management systems are the basis for internal control construction. The core of the system is the approval mechanism, and the approval objectives and approval process are determined in advance by the system and the approval mechanism. The construction of the internal control system of the documentation center involves a total of 29 related systems and 64 processes. The business of the center is subject to approval in advance and supervision after the event. The business level control activities of the documentation center are distributed in various rules and regulations, business processes and business forms related to economic activities and other business fields, and run through the whole business and economic process of the documentation center. According to different work items, the system realizes the functions of sufficient basis for pre-approval, in-process management control in place, and post-event statistical analysis and review.(Fig.1)

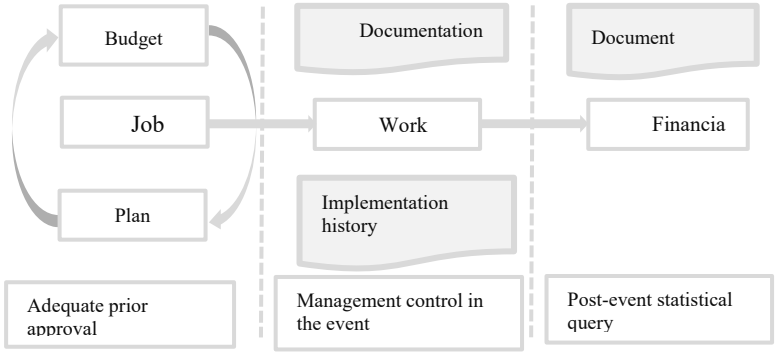

Fig. 1. Internal control system to achieve closed-loop management

4.2 The construction of internal control management system follows the concept of large internal control

The construction of large internal control involves all links within the unit, specifically to the center, including internal work management processes and external service processes. The internal workflow includes: project management, budget management, expenditure management, asset management, contract management, procurement management, personnel management, and other affairs management, such as party development, seal management, conference room management, vehicle management, etc., and OA office system; The external service process mainly involves document data management, including data collection, aggregation, use, release and other processes. The internal control links involving economic activities are key construction projects.

4.3 Internal control system to realize internal all-round management

The core task of the Geoscience Documentation Center.CGS is to focus on a series of literature collection, collation, management and external services, which are closely connected to the outside world, thus regularly deriving processes and tasks such as project management, file management and financial management. Through the effective management of the internal control system for each branch task or process, a series of management implementation and external services around the literature can be better realized.

At the same time, project management and financial management based on the internal control system can also be digitally connected, and task management, expert review, decision-making review and other links are connected with the internal control system to form a complete working system, which facilitates communication and makes the links controllable. Through rules and regulations, decision-making basis and safety management strategy, the full-time ability of the document center can realize risk control and safety restraint guarantee.

4.4 The implementation of intelligent management in the internal control management system

The internal control management system involves various management modules, with built-in systems and risk prevention points, budget execution monitoring, reasonable expenditure control without exceeding standards, compliance in the procurement process, traceability and monitoring of all links, and automatic risk warning, thus achieving intelligent integrated management. The budget management module fully achieves the control goal of "no expenditure without budget, no expenditure beyond budget". In the intelligent internal control platform, the budget management system is the core, and the platform controls the comprehensive and effective execution of the budget process, making all budget data traceable, ensuring that all stages of preparation, review, decomposition, issuance, execution, adjustment, etc. can be standardized. In addition, the budget management system will dynamically track and control the flow of funds and budget indicators, timely grasp the actual situation of budget project execution, and effectively avoid situations where budget indicators are not executed, which can prevent major budget deviations from the source. Finally, integrate the budget system with the accounting system to achieve functions such as budget control reimbursement, reimbursement direct payment, automatic payment accounting, and identifiable invoice authenticity. In the procurement management module, it is possible to effectively solve the difficulty of controlling special funds in procurement, which can to some extent avoid the situation of idle or wasted funds. Secondly, achieve centralized and standardized procurement management. Once again, centralized management of procurement suppliers can be carried out, and the procurement system can input all supplier information, dynamically query, grasp, and manage the actual situation, certificates, and qualifications of suppliers, thereby ensuring the effectiveness of corresponding information.[14]

5 The Implementation Process of Internal Control Management System of Geoscience Document Center.CGS

5.1 Internal control management system construction requirements

According to the internal management requirements of the unit, fully understand the internal management system of the Geological Literature Center, streamline the process, and achieve an integrated management model of project oriented, budget oriented, fund control centered, and risk oriented, achieving full process control of economic business, achieving "pre approval and post traceability". The internal control management information system should have the following functional modules: project management module, budget management module, revenue and expenditure management module, contract management module, asset management module, procurement management module, etc. Realize online approval, automatic flow of online processes, intelligent form filling guidance, automatic reminders of financial requirements such as budget usage, usage scope, and quota standards, and intuitive visualization of management processes.

5.2 The construction plan for internal control management system

The internal control management system of the Geoscience Documentation Center.CGS is planned to be gradually deployed annually. In the first year, conduct system and process sorting, system selection, and requirement analysis; In the second year, we will start building an internal control management information system, incorporating modules mainly related to economics into the system implementation, including project management, financial management, contract management, asset management, and procurement management. Project management mainly involves the business management process, including geological survey projects, scientific research projects, etc., as well as the full process management of external entrusted business, from the early stage of project initiation, procurement, implementation plan review, mid-term quality inspection, result acceptance and other links; Financial management involves the budgeting, expenditure, revenue, and other aspects of funds, running through other modules; Procurement management involves government procurement, non-governmental procurement, and direct procurement. Government procurement requires preliminary procurement plans, approval of procurement documents, registration of procurement results, approval of procurement contracts, and expenditures. Procurement contract management includes revenue contracts and expenditure contracts, involving contract approval, contract signing, and contract registration; The asset management module includes asset registration, requisition and return, inventory, repair, depreciation, scrapping, etc; In the third year, it will be included in business processes such as party building management and personnel management. Gradually digitize all aspects of the center's business.

5.3 The construction Process of Internal Control Management Information System

The construction of internal control system shall be carried out under the leadership of the internal control construction working group of the center, with the main leader of the center as the group leader, and the internal control construction shall be promoted as a whole. Start the internal control construction mobilization meeting, carry out research on relevant units, understand the actual needs of the center, sort out various management systems, sort out relevant processes according to the system, draw flow charts, identify risk prevention and

control points, determine various elements of the approval process, and realize the system functions.（Fig.2）

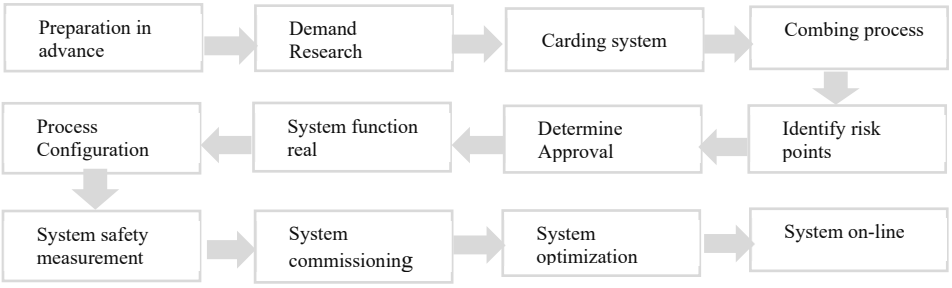

Fig.2. Internal control system construction process

5.4 Functional Architecture of Internal Control Management Information System

In order to facilitate management and iterative update, the sub-process and the connection mode of different processes are clarified in the process combing stage, and the internal control system is built by platform thinking in response to the national platform strategy. The interaction between all processes and processes, the interaction between processes and sub-processes and other auxiliary functions are designed as common modules and driven by a unified platform, and all processes and main functions can be connected to the platform as independent modules.

According to the objectives and characteristics of the unit's work management, the should build a technical system that meets the requirements of the unit's overall financial management and internal control control. Based on the sorting out of the control process of various economic and business activities of the unit, the internal control system is highly integrated with various functional modules such as budget management, expenditure management, procurement management, contract management, project management, asset management, etc., with various internal control means organically embedded and strong fund coordination means.(Fig.3)

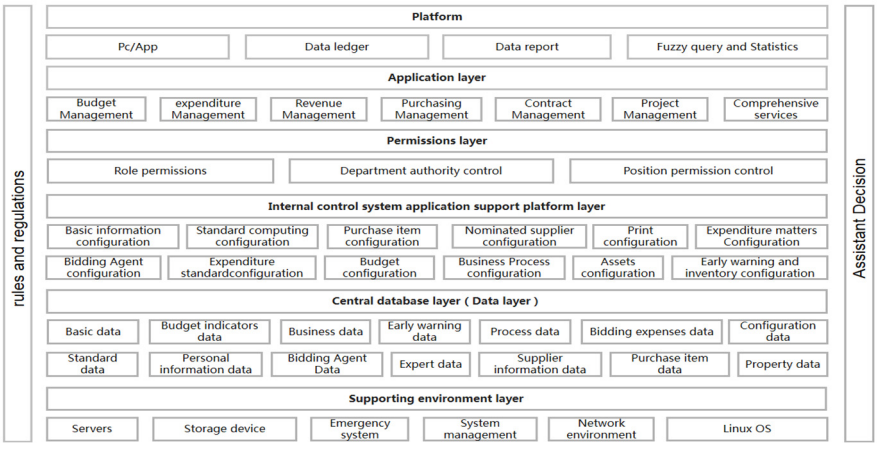

Fig.3. System overall function architecture

The internal control system application support platform includes basic information configuration, standard calculation configuration, procurement item configuration, budget configuration, expenditure item configuration, bidding agent configuration, asset configuration, project configuration, fixed-point supplier configuration, business process configuration, print configuration, early warning and list configuration, etc. The platform layer accepts control rules and sets the control rules through system parameters to form system embedded rules. This part is the key to the normal operation of the system user's application, approval, query and so on.

The user access control permission layer sets permission control for the user's role, department, and position. Users with different permissions enter the system to process related businesses and exercise corresponding powers according to their respective job responsibilities. At the same time, permission permission is set for cross-department and cross-functional process connection nodes. Administrators can set cross-department and cross-functional permissions according to actual conditions to ensure the smoothness of review and approval.

The application layer includes functional modules such as internal control budget management, expenditure management, revenue management, procurement process control, contract management, project management, and integrated services (performance accountability, multi-dimensional statistical analysis). The application layer adopts modular design, and each module is highly integrated.

The system automatically collects all kinds of business data at regular intervals to form all kinds of data ledgers, including project ledgers, index ledgers, purchase ledgers, contract ledgers, asset ledgers, etc. Leaders and managers at all levels can timely grasp the overall situation of each business and assist leaders in analysis and decision-making through various query statistics.

APP system includes all kinds of business in the mobile terminal approval and application, direct reimbursement, expense reimbursement and other mobile reporting functions; Mobile application and PC-side business adopt asynchronous homologous architecture, and both ends can realize filling and approval.

5.5 Functional Architecture of the Internal Control Management Information System

The domestic internal control system adopts a B/S architecture and is developed based on the JAVA architecture. By integrating existing service buses and following corresponding bus service specifications, it realizes the integration and sharing of internal and external system data, adopting a centralized system structure; The presentation layer adopts the latest internet application technology design, supporting multiple browsers and access devices (such as PC and mobile devices); The system has summarized some mature functions as system support components, making system development and operation more standardized and improving efficiency.(Fig.4)

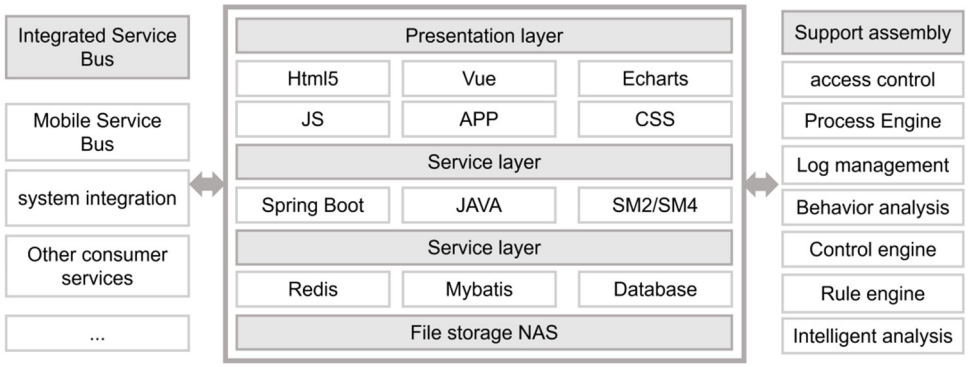

Fig.4. System technical architecture

5.6 The system adopts the main technology

By using a pre loaded service approach, some system services are loaded into the platform.

Data compression technology: To improve the transmission efficiency of data, the compression ratio is generally 3-10 times. Saving bandwidth, reducing network load, making decryption more difficult, reducing the amount of data that needs to be encrypted, and also reducing the CPU resources required for encryption.

Data encryption technology RSA+DES: Using RSA technology to discuss keys, DES algorithm encrypts data, ensuring data security during transmission.

Connection Pool Management Service: In terms of customer access to the database, the time spent by customers accessing the database server is much less than the intermittent time. Therefore, using connection pools allows multiple customers to share database connections through borrowing, and can control the number of concurrent connections on the database, improving the overall efficiency of the system.

Provides Cluster functionality, supporting application clusters composed of multiple machines, and allocates application requests to each machine in the cluster through selectable load balancing algorithms.

Workflow technology: Workflow is a type of business process that can be fully or partially automated. Capable of transmitting and executing between different departments and personnel based on a series of rules, documents, information, and tasks. Users only need to fill out relevant business forms on the computer, and the system will automatically flow down according to the defined process. The next level of approvers will receive relevant information and can modify, track, manage, query, statistics, print, etc. as needed, greatly improving efficiency and realizing the customization of user business processes and business management transformation needs.

5.7 Design of Connection Relationships between System Modules

The internal control management system effectively connects various modules according to business process relationships, achieving pre application and approval, in-process supervision, and post traceability. Each link is interrelated and mutually restrictive. (Fig.5) And through

the built-in standard library, system library, expert library, bidding agent and other information, personnel operations are reduced. For important information such as contracts and quality assurance deposit payments, personnel at each stage are automatically reminded to take actions according to time nodes. Through intelligent functions, risks caused by personnel misdirection are avoided.

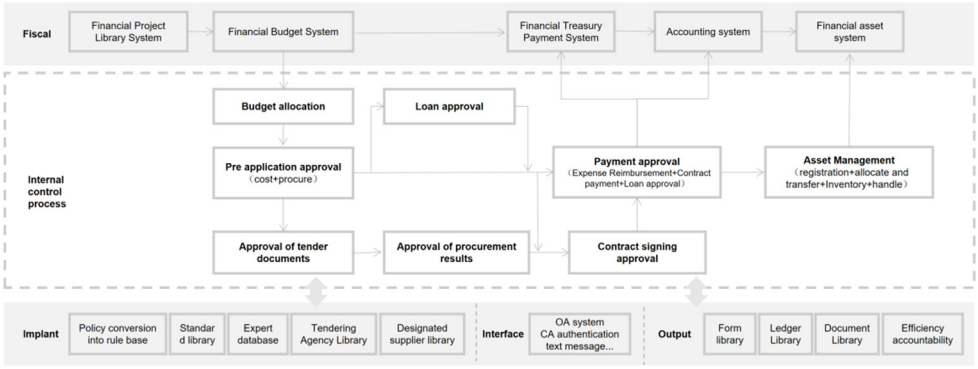

Fig.5. The connection relationship between various modules of the system

5.8 Key link implementation code

The internal control management system focuses on achieving "pre approval and post traceability". For example, the main codes for the approval process are as follows:

```
@Override
   @Transactional(rollbackFor = Exception.class)
   public synchronized void taskApproval(TaskApprovalParams params) {
      if (StrUtil.isNotBlank(params.getAssignor())) {
         SysUser user = userRepository.findFirstBySysPersonnelIdEquals(params.getAssignor());
         if (user != null)
            params.setAssignor(user.getId());
      }
      if (ArrayUtil.isNotEmpty(params.getAssignors())) {
         List<String> uids = userRepository.findUserIdByPersonnelIdIn(Arrays.asList(params.getAssignors()));
         if (CollUtil.isNotEmpty(uids))
            params.setAssignors(uids.toArray(new String[]{}));
      }
      if (StringUtils.isNotBlank(params.getHandSignture())) {
```

```
            addNodeUserSignture(params);
        }
        switch (params.getTaskAuditedType()) {
            case ApproveTypeConstants.PASS:
                executePass(params);
                break;
            case ApproveTypeConstants.FAIL:
                executeFail(params);
                break;
            case ApproveTypeConstants.BACKOFF:
                executeBackOff(params);
                break;
            case ApproveTypeConstants.SIGN:
                executeSign(params);
                break;
            case ApproveTypeConstants.REFERRAL:
                executeReferral(params);
                break;
            case ApproveTypeConstants.RECALL:
                executeRecall(params);
                break;
            case ApproveTypeConstants.POINTTOPOINT:
                executePointToPoint(params);
                break;
        }
        TenantContext.BeforeCrossEnterpriseId.remove();
    }
```

5.9 System optimization and iteration

The internal control management system has been tested and put into operation. We will continuously collect user feedback through the established user feedback mechanism, optimize

and iterate based on the actual needs and application scenarios of management personnel and actual users during the use process, and continuously optimize system functions and performance to adapt to the constantly changing management needs and market environment.

6 Conclusions

The effective establishment of the internal control management system of the Geoscience Documentation Center.CGS has standardized, processed, automated, and intelligent business operations, achieved power balance, reduced management risks, effectively connected business processes, and achieved full process management of economic activities, greatly enhancing the efficient management and healthy development of the unit. At the same time, with the development of artificial intelligence, AI technology is being used to provide more efficient productivity tools for units, such as intelligent question answering, intelligent document generation, and other auxiliary management, to improve efficiency.

Funding Resources: Geological survey project of China Geological Survey: Geoscience Literature Knowledge Service and Decision Support(DD20230139)

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