

# RESEARCH ON CONSTRUCTION AND APPLICATIONS OF MANAGEMENT INFORMATION SYSTEM IN HIGHWAY ENTERPRISE

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**Keywords:** Highway Enterprise, Management informationization, Business information platform for the integrated management control.

**Abstract:** Through long-term studies on Highway industry, this article described importance and difficulty in demand of information management from five aspects of the highway business, and putted forward solutions and overall planning of constructing the integration platform of economic business management and control for information. Demonstrate this idea by F enterprises as an example.

## 1 INTRODUCTION

Highway enterprises have some features in the industry status and development trend and its own characteristics, including:

- Monopoly and public service. To promote the highway construction of traffic system, the state actively encouraged investment in all sources of funds. However, as it related to people's livelihood, the State Highway Administration on the whole is still in a monopoly position. First, investment monopoly, the state highway that is the main component of investment accounts; Second, business monopolies, highway toll operators were licensed by the State; Third, local monopoly, in a certain area, the less of the parallel road with the industry competition;
- Capital-intensive And Sunk costs. It is well known that highway is infrastructure, huge investment and long construction period, as well as capital payback period. Once the capital invested, it can not be effectively transformed into;

- Linear distribution, management and maintenance are complex.

## 2 RESEARCH ON APPLICATION HIGHWAY INFORMATION MANAGEMENT SYSTEM

This section analyzed the importance and difficulties of expressway construction management, proposed the theory that integrating management and control for business operations management, and made an assay on the application of key technologies.

### 2.1 Analysis of the Enterprise Management Information in Highway Industry

In the complex model of freeway, Management on human beings, finance, goods are undoubtedly the basic lines, the most important of which is financial management. Form the "neural network" by analyzing budget, finance, investment, operations, revenue, cost and economic. Management activities throughout the entire process permeate all aspects of business execution.

### 2.1.1 Economic Closed-loop involve Resources Integration and Efficiency

During the highway project construction and asset formation, it is necessary to ensure the safety of the use of funds. Highway construction projects have more locations, suppliers and longer periods. Economic management must be in-depth assessment of the project, budget review, tendering, bid evaluation, contract development of the economy, project execution, and final acceptance, the whole process of preparation of final accounts.

After highway project completed, it had formed a economic cycle which is the progress of charges - expenses - loan management, and in it income and expenditure of funds is very large, so it is important to clearly reflect the flow of capital flow and monitor the state.

In terms of highway maintenance, implement the operation rules strictly, and control costs reasonably. On inputs of manual works, materials, and maintenance of engineering equipment and working materials, the meticulous management is ensuring the conservation of quality, while lowering operating costs and increase operating earnings.

### 2.1.2 Economic Context Associated with the Quality of Internal Control and Risk Management

Because large-scale investment, long period, as well as many links in fund management, a relatively long time, it is easy to breed waste, misuse, misappropriation, and other violations irregularities, thus establishment of the internal control system and risk management is undoubtedly critical.

Formed an economic network by combining budget, finance, financial, economic assets, whether is clear and can be traced back, is an important indicator of the perfection degree for internal control and risk. First, started from the business operations, each data links are established in the relationship upstream and downstream and any one of them can be inquired traceability information on the front part. Secondly, every aspects of specific responsibilities, a clear record of operations, audit and supervision of incompatible rights holders, so that responsibility for duty, for people, all long-term preservation of records.

## 2.2 The Establishment of Economic Business Management and Control Integrated Management Platform, Internal Control and Risk Management

To this end, two aspects need to build economic and business regulatory framework integration. One is the main line of top-down line, through the company headquarters, molecular Company, branch, department, business unit of execution. Another dimension is information integration, from a business executive, management, management decision-making at three levels, from the bottom up, layer by layer information collection, integration, unity and integration to the shared data center management and control platform.

### 2.2.1 Integrated Management and Control Framework

As shown below is the integration of economic and business regulatory framework, in support of business management and control integration to mainly achieve the following management objectives:

- Company Headquarters — Subsidiaries: Resources, Approval, Monitoring

According to corporate strategic planning and highway business plan, established a comprehensive budget system. Company headquarters is responsible for integration of resources, asset allocation, financing, approval of investment projects, investment monitoring, cash management, funds settlement and financial accounting, reporting and analysis.

- Subsidiaries — Execution Unit: Business Management, Implementation and Feedback

Business entities undertake concrete projects, roads, business operations and business development. Road Construction Company track and manage the life cycle of the project budget estimate, plan, schedule, quality, contract and cost. Supervision during approval and budget, supervise the implementation, and accurate or complete information on project implementation feeding back into the financial, human resources, assets and investment platform for centralized control.

Operation Corporation is responsible for access fees, road maintenance, toll revenue paid, operating expenses and maintenance, through appropriate projects, submitted to the funding plan and appropriated the use inside diameter in the budget.

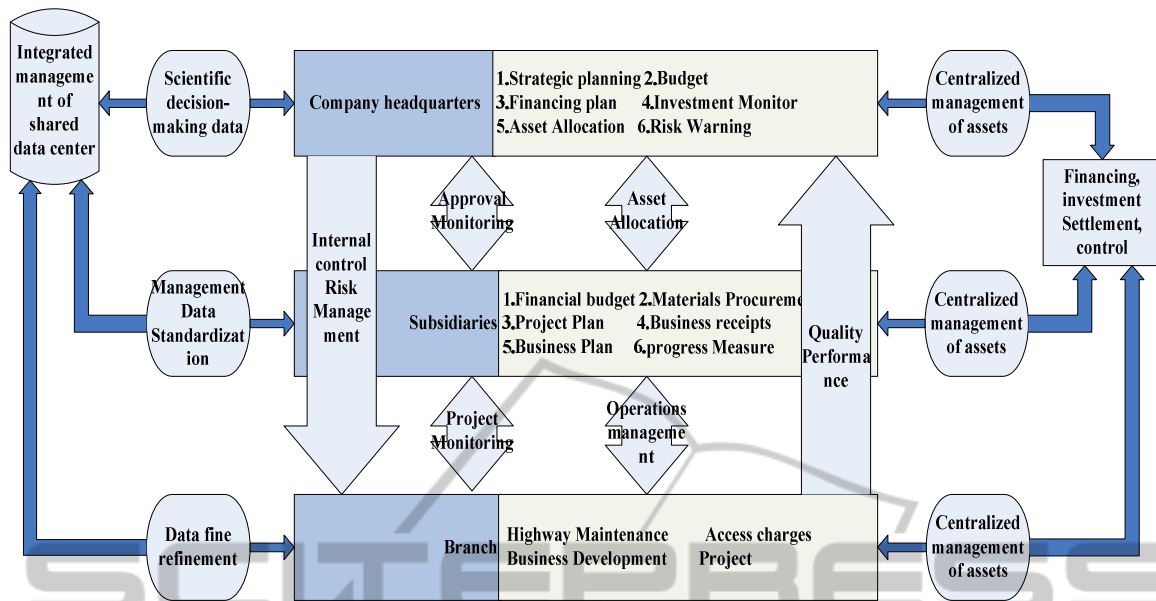


Figure 1: The integration of economic and business regulatory framework.

Business selects the control mode according to format, business data, particularly in relation to the economic value of the inflow and outflow of data records to be fine and back to the integrated control platform.

Aimed at strategic performance management, use a comprehensive budget management as the holder, break plans down, carry out and implement business unit. Improve the system construction, strengthen the human, financial, and material resource, which opened up the implementation of the strategic management and business channel layer, domain information of each control system to provide upward feedback results of operations, analysis, downward, and penetrated into the implementation aspects of the business, ensuring real-time, accurate data collection, operational control and information sharing.

Finally, the implementation of 'construction, management and support' business execution system includes the project construction management, fee management, equipment management, road property resource management, road management and maintenance management. Connect with documents and process, Main lining by funds and programs.

### 2.2.2 Integration Platform

Achieve integration of economic activities, information sharing and process unimpeded. Data platform needs support layer. The core of business management is Master data management platform,

application integration platform, data warehouse platform, information portal.

- Master Data Management Platform

Master Data Management used as describe highway enterprise business entity, including: personnel, assets, bank accounts, subject, customers, suppliers, materials, inventory, and the public's classification system, coding system and other public property and the basic file, involving Basic data of every information systems in core business process. It is also the foundation if want to realize Standardize and streamline.

- Application Integration Platform

The important one of application integration platform is Enterprise Service Bus, which can simplify the system structure, reduce the number of interfaces and support flexibility and scalability of system. Achieve real-time control of all critical data; improve decision-making efficiency and speed of response, through classifying and integrating of all data and information, unified information integration platform.

- Data Warehouse

Based on Business Intelligence Technology, data warehouse is able to complete data acquisition, loading and converting. Then data processing, finally, formed as Statement analysis, index analysis and management of cockpit, Integrated into the enterprise information portal to set out.

- Information Portal

Integrated accesses for internal and external personnel, reduced the number of user accounts and

passwords, made the interview convenient for corporate customers, business partners and internal staff, so that different people can get in a unified content adaptation interface, improve security, easy for management. It can lower the costs of investment and distributed for different systems. Display platform to provide personal information to accelerate business efficiency.

### 2.3 Key Technologies

To overall information technology infrastructure management system, we should focus to consider the existing management of the enterprise. On the one hand Expressway Company has the wide distribution application, located in all the branches across the province. On the other hand B / S architecture technology has been mature. Therefore, you can use the B / S technology architecture to achieve business focus and data set management objectives.

The mainstream of the current international framework are J2EE and .Net, they all have their

own advantages, while J2EE seems more suitable for the use of highway enterprise, on consider of finance and cost.

There are many other highway monitoring system, measuring system and charging system, data of these systems will inevitably keep up financial management system to produce data exchange requirements, so it is necessary to provide an integrated platform to meet the needs of data exchange.

### 2.4 Application Deployment Model

Different management companies have different business models and organizational structure. For that, in the long term development of information technology investments and maximize the principle of conservation, should be fully centralized deployment model. Application deployment diagram shown below:

The centralized model has the advantages: highly integrated operations and highly concentration of data. However, the quality requirements of network

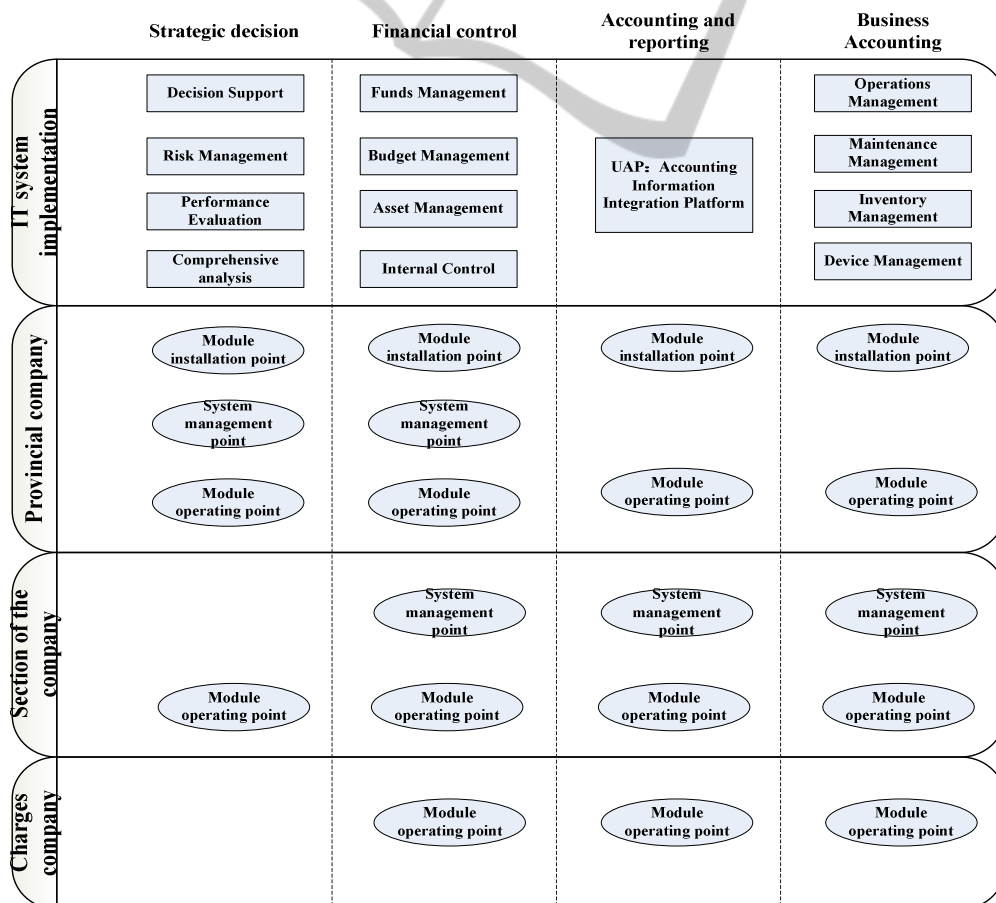


Figure 2: Application deployment diagram.

access is relatively high, while security and stability of the server, higher levels of requirements, which is upgrading the server equipment and network equipment, upgrading of the objective requirements.

## 2.5 Network Solutions

### 2.5.1 Structure

At all levels of the user terminal without having to install software, but through the network data transfer protocol HTTP, through the WEB server, application server, the corresponding data processing, then be stored on the database server. For any end-user to view data and operations. This network will help the real-time data transmission to ensure data safety and reliability.

### 2.5.2 Analysis on Data Network Security

Analysis from the topology of the network, mainly from the WEB server and database server for the network security policy to ensure the security of data, thus ensuring the security of the entire financial system, reliability.

## 2.6 MIS Development Technology

Large enterprises continue to shape the development of highway, also continued to improve enterprise management mode, Management system development for this technology must meet 'one-stop single sign-on, unified workflow engine, a unified organizational structure and access control, integrated database management'.

As shown below for the development of platform system:

- Fundamental Technology Platform

This fundamental technology platform is based J2EE, cross-database, Cross-operating system. Support application distribution, security and transaction management, providing dynamic load balancing capabilities to provide system resource monitoring and management capabilities.

- Organizational Structure of Enterprises based on Multi-application Platform

Meet the needs of individual users, support the business model simulation, analysis, diagnosis, optimization and adjustment.

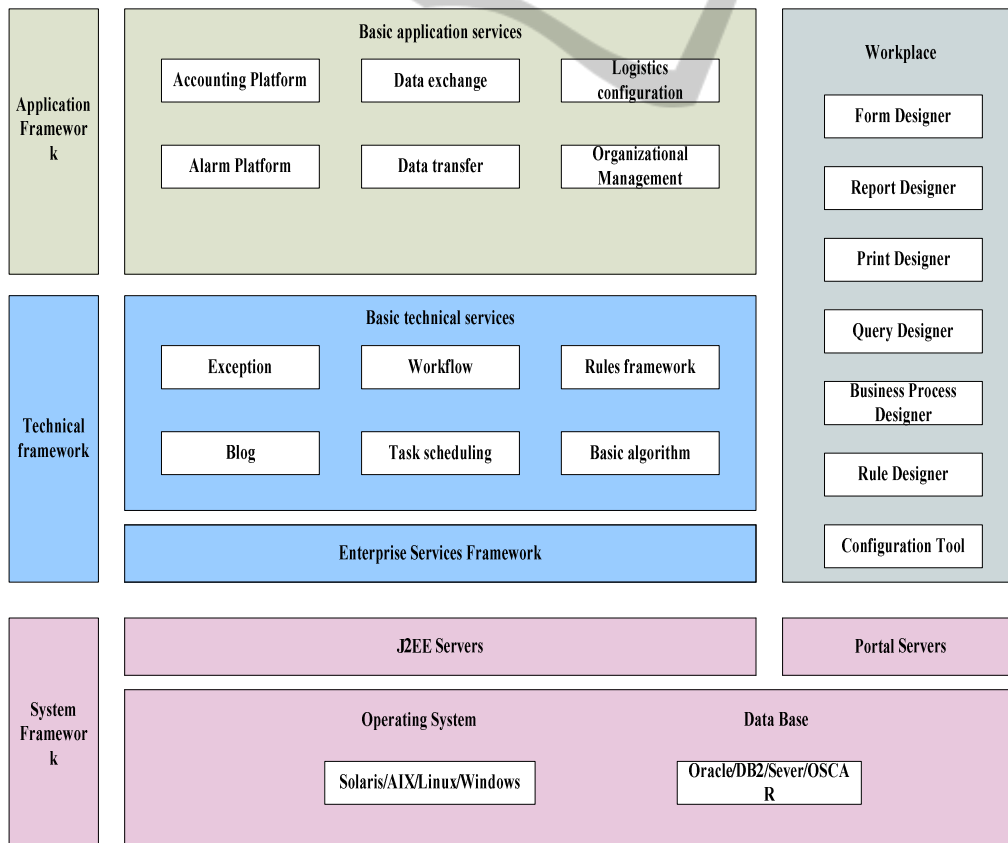


Figure 3: The development of platform system.

- Platform based on Development Modular Forms, reports, prints, check functional standardization.
  - Open Integration Platform
- Data switching and transmission architecture based on SOA technology.

### **3 CASE STUDY ON ECONOMIC BUSINESS CONTROL INFORMATION SYSTEMS IN HIGHWAY INDUSTRY**

#### **3.1 Background of Company**

Highway Co. Ltd. F established in 1997, is an emerging transport infrastructure state-owned enterprises, the SASAC is the first province to fulfill the responsibilities of investor in one of 17 companies with total assets over 130 billion. Experience the ten-year development, highway construction has scaled a new height, in the end of 2010, the province's highways mileage reached 2,300 km. 2015 will reach 6,100 kilometers, will be formed the province's highway network and covering all the counties.

Company F pays great attention to the construction information, Benefited from the unified system of vertical management model, the province's information technology highway always stays forefront of the country. In this planning, based on the progressive completion of several large-scale implemented of related projects and construction, the "digital highway" (1st phase) project was officially approved in June 2005.

With the rapid growth of the scale and advances in information technology, Companies F need a financial management to promote the coordinated development and improve the Group's efficiency. In 2007, as an important component of the "digital highway", it began construction of "centralized financial management system".

#### **3.2 Process of Economic Business Management and Control System Construction**

Company F "centralized financial management system", of which the scope is at all levels of road and affiliated companies, including 56 under the Molecular Corporation, more than 170 foot layer companies.

Modules include five major systems: Financial management system, accounting system, budget management system, asset management system and decision support analysis system. And as well the Group's financial management information system and the "digital highway" system platforms and other specialized system interface.

Company F focused on building financial management system project the official start from February 5, 2007 and completed in December 2010, reached the following objectives:

##### **3.2.1 Achieved Centralized and Unified Financial Management**

Before Company F constructed centralized financial management system, accounting system of every subsidiaries are divided into several parts to establish different financial management software. Just like information silos, data are inconsistencies, and as well there is no internal control system and a relatively perfect financial management practices, can not achieve effectiveness. Without information system, data delayed, huge workloads, and less efficiency, often also prone to delays and data distortion.

Through the establishment of a unified financial management system, company focused on road platform, centralized management of data, standardized accounting courses, fixed asset base to achieve the standard management information, satisfied the data management requirements of timeliness and authenticity.

##### **3.2.2 Achieved Centralized Funds Management**

Make the members of Company F headquarters and enterprises flexible, efficient and safe by using capital allocation system. It must ensure that the funds flow, reduce costs; improve capital utilization, building an effective system of flexible internal settlement to Concentration of funds and debt.

Through advanced financial management system and funds management institution, realize the functions accurately that check the implementation of accounting and management accounting timely, reduce the external circulation of funds, transparentizing capital flow of company.

##### **3.2.3 Report Accurate and Efficient**

Established and consolidated financial statements for the formation of efficient system, by using IUFO report, form different reports generated report object

in time, such as main table accounting, management reporting, the SAC report, at the same time meet the combined requirements of the different scope of consolidation and the consolidated financial statements issued by the appropriate.

In the report construction of company F, basic setting can set offset relations and offset projects and maintain equity data.

### 3.2.4 Budget Management

As a useful tool to combine member development strategy and business objectives of company F, budget management play a major role in strengthen the company's control and mobilize positive of members. Nowadays, according to the requirements, Company F has achieved a budget table budget at all levels between the subjects reported the preparation, approval, approved, issued a report, summary; and other processes to achieve both the number of real-time access and analyze the implementation.

### 3.2.5 Asset Management

Asset management to define and standardize business processes and accounting methods, achieve the combine financial management and material management; ensure the full control of asset value and material, improve asset efficiency, clear responsibility for asset management, Prevent non-normal damage and loss of assets.

The management model that Centralized management control, but different people take the responsibility can improve the efficiency and accuracy of accounting.

- Asset Lifecycle Management can help the company overall management of the fixed assets, and track it.
- Monitor and manage to the key step of budget of assets and implementation.
- Multidimensional statistical analysis on asset.

### 3.2.6 Decision Analysis Management

After applying on decision analysis management, the company had achieved functional requirements: a comprehensive analysis of the preliminary inquiry, performance evaluation, decision support, including real-time summary report of their overall real-time analysis of performance indicators, key economic indicators provide immediate, on the immediate implementation of business strategy understanding of the important indicators of the group through the completion of inquiries.

### 3.2.7 General Benefits

This can achieve the dual focus on business and the unified data management; reduce manual processing of business processes brought about due to the inaccuracy of data, improve the timeliness of reporting and accuracy, provides a basis for accurate analysis of the data for the decision-making.

## 3.3 Late Planning

For longer-term development and better use of information technology management services for enterprises, company F proposed information technology, expected in the next 5 years, building an economic activity information platforms and information management system, mainlining income and expenditure of funds, covering the construction and operation management business, integrating management of highway projects, toll, maintenance, operation and development, monitoring, Highways and other information, implementation of information collection, integration.

## 4 CONCLUSIONS

Since 2007 Company F running highway construction information management project, had almost realized requirements of centralized management and control of financial, and brought benefit in economic and social work.

This case shows , the information system on economic business control management as this paper had put forward , is perfectly useful , technology applied is advanced , architecture is reasonable , the company could meet the realistic needs of highway industry on the management informationize, and this can be applied of the highway industry in more promotion.

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