Data Empowerment and Risk Management: The Data Application Practice of Fund Credit Management in a Group company

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Abstract. As a provincial-level large state-owned energy conglomerate, the group company operates across multiple sectors including power, petroleum, and coal. With numerous subsidiaries and complex fund activities, it faces multiple challenges in fund management. Critical pain points exist at the strategic level, operational level, and resource allocation level. Against this background, the group company proactively responded to the State-owned Assets Supervision and Administration Commission (SASAC) directive to accelerate treasury system development. Aligning with provincial policies on fund credit risk management for provincial enterprises, it initiated construction of a Fund Credit Risk Management System. Adopting a "11+4" framework, the system integrates multi-dimensional data including accounts, financing, guarantees, and bills to enhance the precision, centralization, and intelligence of fund management. The SASAC Financial Risk Monitoring Platform is a key digital reform initiative under the 14th Five-Year Plan. In May 2022, the group company was tasked with developing the fund credit risk management subsystem. By October 2022, the system had been successfully deployed across all 17 provincial state-owned enterprises, significantly elevating the fund credit risk management capabilities of provincial state-owned assets and enterprises.

Keywords: Fund Credit Risk; Group Treasury Construction; Fund Management Reform; Fund Data; Fund Management Decision-making

1 Introduction

1.1 Policy Context

In recent years, treasury constraction has gained significant momentum. Central and local governments have issued numerous documents to promote reforms in centralized fund management. In January 2022, the SASAC issued Document No. 1, "Opinions on Promoting Central Enterprises to Accelerate Treasury System Construction and Further Strengthen Fund Management" (Guo Zi Fa Cai Ping Gui [2022] No. 1) [1], and Document No. 23, "Guiding Opinions on Central Enterprises Accelerating the Construction of World-Class Financial Management Systems" (Guo Zi Fa Cai Ping

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Gui [2022] No. 23)[2]. It points out that enterprises should strengthen internal control over funds by leveraging financial information systems. Funds are the lifeblood of an enterprise, and a treasury system acts like a heart, directing the group's resources to where they are needed. Simultaneously, fund security serves as the foundation for resource allocation and value creation. Risk prevention and control should address fraud risks, compliance risks, liquidity risks, and financial market risks, identifying root causes and clarifying oversight responsibilities between the Group and its subsidiaries. This ensures fund operations comply with regulations and align with the Group's strategic direction from the outset, thereby enhancing value creation capabilities[3]. Consequently, a certain group company initiated the promotion of its group treasury construction and fund management reform.

1.2 Current Challenges

As a large state-owned enterprise with the full energy industry chain, a certain group company currently controls over hundreds of entities across eight major business segments, including electric power and petroleum. The group's multi-sector operational model and growing business demands have presented significant challenges to its fund management reform, primarily in three areas.

First, from a strategic perspective, the certain group company, as a provincial state-owned enterprise possesses a complex supply chain system with diverse cash flow characteristics. Its diverse business composition also complicates the establishment of a fund ecosystem.

Second, a significant challenge lies in maximizing the value of funds. The expanding scale of funds makes it increasingly difficult to enhance returns while ensuring liquidity.

Third, resource allocation presents another difficulty. The expansion of the certain group company has led to an increasingly complex equity relationships, making it challenging to construct a comprehensive fund risk control system.

In response to these issues, a detailed investigation into the group's current fund management practices revealed several prominent problems: decentralized bank accounts, a lack of full-process interconnection and flow in business, the absence of a comprehensive and practical management monitoring and analysis system, and relatively weak management of overseas funds.

1.3 Proposed Solution

To address the aforementioned challenges in the group's fund management and to respond to the central government's call to accelerate the construction of treasury management systems, we developed a solution based on fundamental methodologies of fund control.

For overall planning, we established a three-in-one management system, centered on three main business entities—the Group, the Finance Company, and the Financial Shared Service Center (FSSC)—to achieve unified management of the group. The finance company plays a pivotal role in the overall group's fund management system[4].

Furthermore, drawing inspiration from the "11+4" construction framework mentioned in the SASAC's No. 1 document, we designed the Fund Management System by incorporating 11 types of business data and 4 types of risk warning pools.

2 Data Overview

2.1 Overall Architecture

The core functional modules of the Fund Credit Management System include Account Management, Financing Management, Fund Credit Output Management, Donation Management, Bill Management, Fund Management, Debt Risk Monitoring, and Fund Budget Management. The system integrates, consolidates, and outputs collected financial data to form a digital cockpit and generate reports for the SASAC. Additionally, it incorporates mobile application Development, master data platform integration and other multi-platform integration, and system integration with the SAP, the FSSC, and the Jiuhengxing System. This cross-platform integration breaks down silos, achieving business-finance integration, information sharing, and closed-loop management. The system functional architecture is shown in Figure 1.

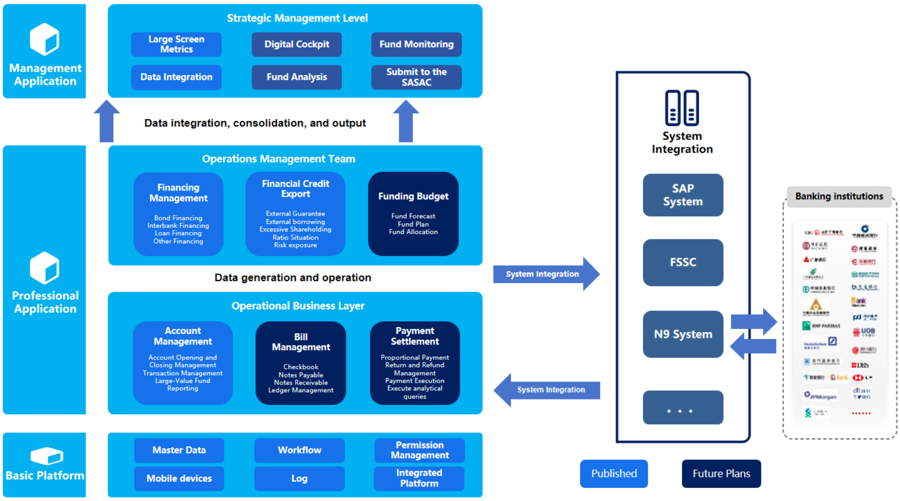

Fig. 1. System Functional Architecture

In terms of system architecture, the Fund Credit Risk Management System is primarily divided into two components: one deployed on the corporate side and the other on the SASAC side. Both sides utilize multiple application servers for load balancing. Requests are reverse-proxied to backend services via Nginx. The relational database employs MySQL in a primary-standby architecture. Middleware components include the non-relational database Redis, the distributed task scheduling platform XXL-Job, and the file storage solution MinIO.

Security is the foremost consideration in the technical design, employing multi-layered security strategies including data encryption to protect the system from attacks. Monitoring encompasses server CPU and memory usage for timely issue resolution. All user operations are logged to facilitate root cause analysis.

2.2 Data Sources and Preprocessing

2.2.1 Organizational Structure Management. The system was constructed in two parts. First, in accordance with the requirements of a certain SASAC, a fund credit risk subsystem has been established under its financial risk monitoring platform. This subsystem is deployed for use by the Provincial SASAC and all provincial state-owned enterprises, with the aim of strengthening the fund credit risk monitoring. Second, a fund management system developed based on a certain group company's fund management needs, aiming to enhance the refinement, intensification, and intelligence of fund management, thereby improving fund operational efficiency and preventing fund risks. Up to now, the system on the side of the SASAC has been implemented across more than ten provincial enterprise groups, overseeing several thousand supervised entities. The enterprise-side system has been implemented across all more than ten business sectors and nearly a thousand member units of a certain group company.

2.2.2 Account Management. Regarding account management, The Fund Credit Management System provides visualization of account information, reinforces unified group account information standards, establishes account information archives, stores comprehensive account data across multiple dimensions, controls account quantities, and promptly cleanses inefficient accounts. Currently, it has collected 3,107 group account data records and 31 competitive deposit data records. A unified approval process for opening and closing accounts has been established, managing the entire lifecycle of account creation, modification, and closure. To date, 699 processes have been initiated within the system. The system interfaces with the financial company's new generation core system, online banking systems, and the FSSC to retrieve bank account balances and transaction histories. Through statistical analysis of large-value fund flows, it promptly identifies abnormal transactions, reports them as required by SASAC, eliminates non-compliant transactions and prevents operational risks. So far, 2,855,991 large-value transaction details have been reported. The specific system interface is shown in Figure 2.

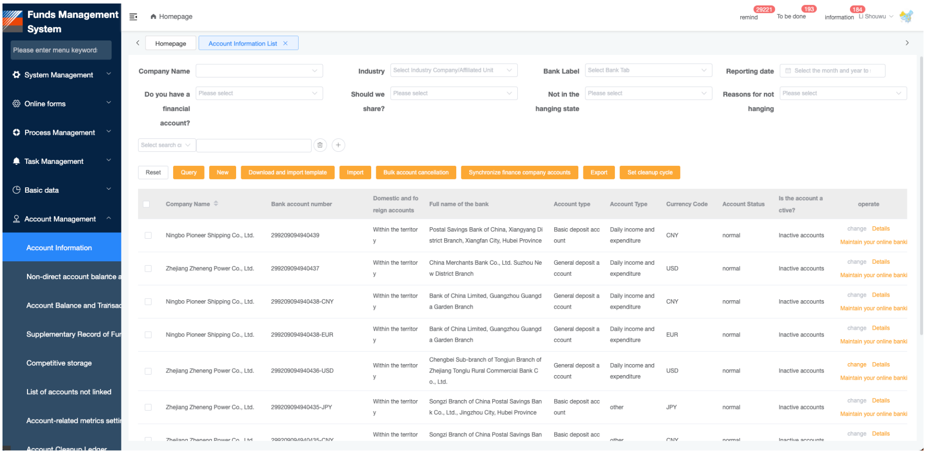

Fig. 2. Account Management Module

2.2.3 Financing Management. For the Group's financing data management, the system collects and analyzes four types of financing data for the group: bonds, loans, interbank financing, and other financing activities. To date, it has collected several dozen bond contract records, thousands of loan contract records, and hundreds of interbank financing and other contract records. In loan-related business, the management of loan data is carried out at the contract-promissory note level. Currently, several thousand promissory note records have been collected, with over ten interest calculation and payment methods configured. Interest rates are calculated based on the current Loan Prime Rate (LPR), enabling the automatic generation of loan principal and interest repayment schedules. This data is pushed in real-time to the FSSC for accounting treatment. The specific system interface is shown in Figures 3 and 4.

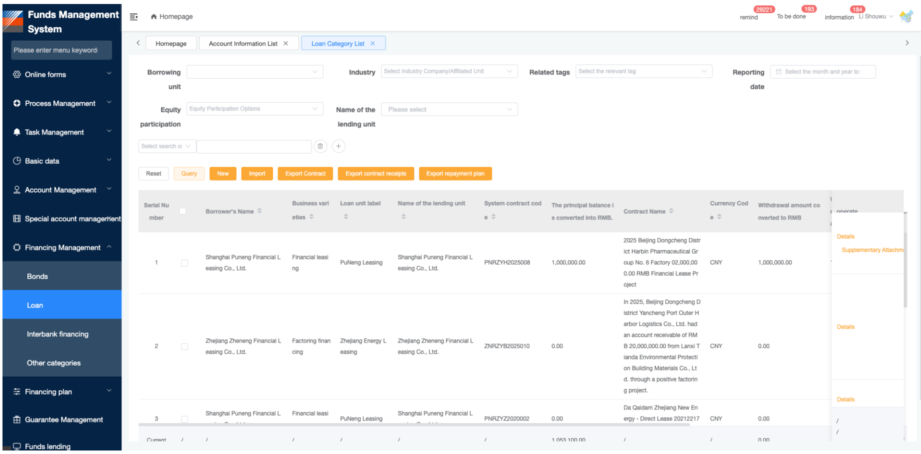

Fig. 3. Financing Management Module - Loan Contract List

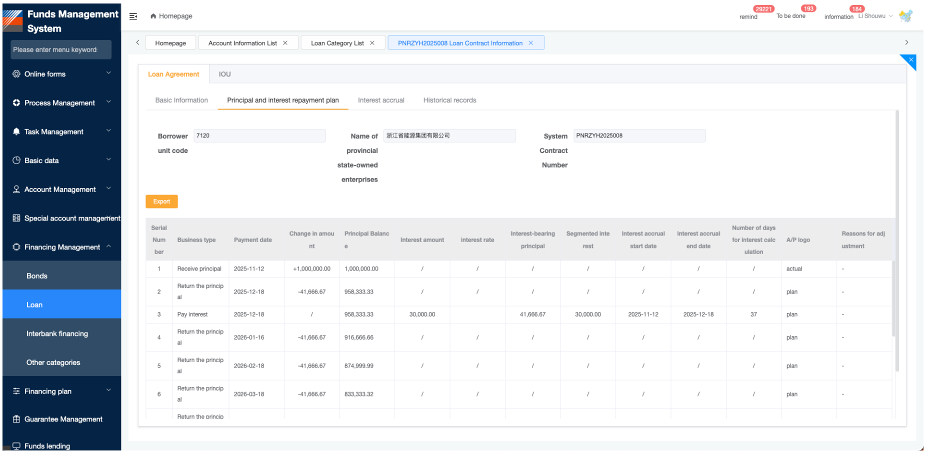

Fig. 4. Financing Management Module - Loan Contract Principal and Interest Repayment Schedule

2.2.4 Fund Credit Output Management. This Fund Credit Output Management enables intelligent control over external guarantees provided by member units. It automatically collects guarantee contract data, categorized into external guarantees and intra-group guarantees, with hundreds of contracts recorded so far. It also calculates 11 key elements, including guarantee ratio, equity ratio, and risk exposure, to facilitate intelligent management of guarantee data. See Figure 5 below for details.

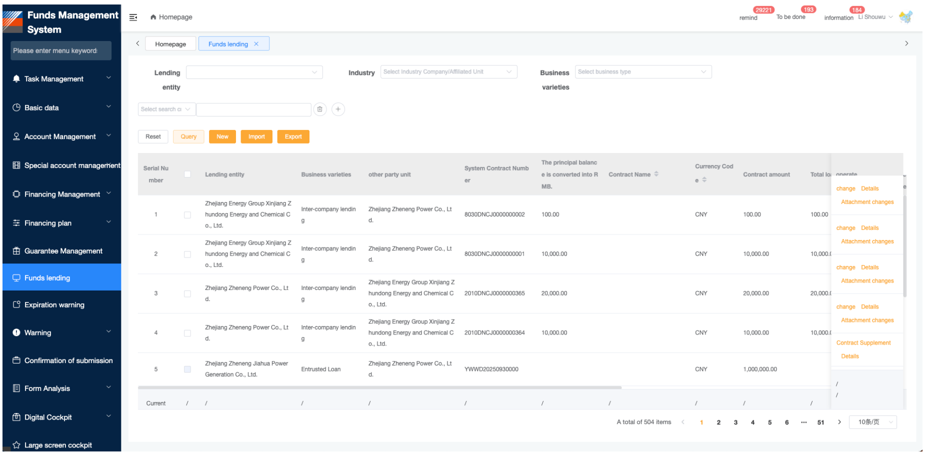

Fig. 5. Fund Credit Output Module

2.2.5 Fund Lending Management. The external lending management module primarily covers the group's external and internal lending management, subdivided into two business types: inter-company loans and entrusted loans. It provides refined management of loan contracts, disbursement orders, repayment schedules, and fee information to meet the management needs for both types of lending.

2.2.6 Bill Management. This bill management module connects directly with the Clearinghouse, enabling dynamic collection of bill information. It provides centralized management and visual monitoring of data on notes receivable and payable. It also interfaces with the FSSC for accounting treatment, enabling full-process management of bill issuance, endorsement, discounting, and payment.

2.2.7 Donation Management. The donation management module provides statistical analysis of donation projects across the group's companies, with several dozen donation records collected to date. The system performs multi-dimensional analysis of donation amounts, budget execution, donation types, sources, and channels.

3 Algorithms and Applications

3.1 Model Construction

3.1.1 Supervision and early warning model.

3.1.1.1 Fund Risk Early Warning. The Fund Management System enhances the refined management of accounts by building modules for special-purpose accounts and competitive deposits. Based on this, it generates various reports, such as fund deposit details and fund pooling statistical analysis. It provides regular feedback to group enterprises on fund deposits and non-poolable fund account balances, enabling periodic fund pooling. It also implements threshold early warnings for fund pooling rates to strengthen centralized fund account management.

3.1.1.2 Transaction Balance Monitoring. The Fund Credit Management System enables dynamic monitoring of account balances and transaction flows.

It establishes rules for early warning analysis, performing compliance analysis and providing alerts on information such as transaction counterparties, amounts, frequencies, and fund usage. This enables multiple warning functions, including early warnings for abnormal transactions, discrepancies between balances and transactions, and insufficient balances for principal and interest repayments. As shown in Figure 6.

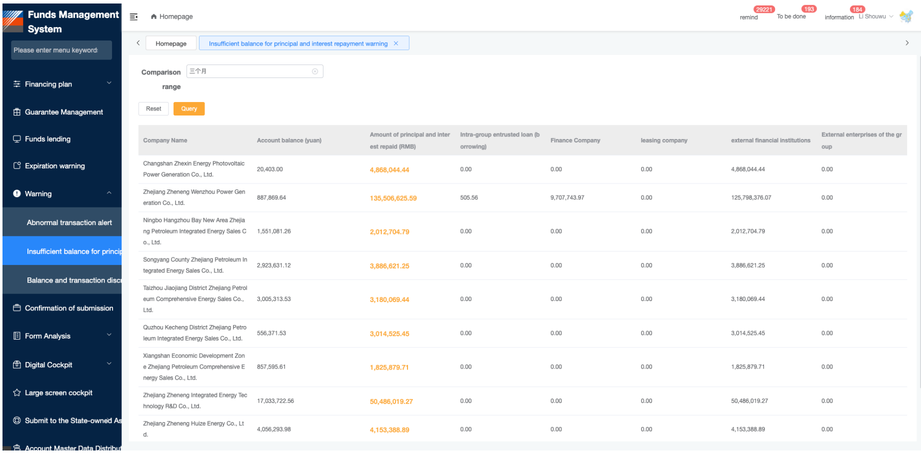

Fig. 6. Early Warnings for Insufficient Balance for Principal and Interest Repayment

3.1.1.3 Debt Risk Early Warning. Through real-time calculation of principal and interest repayment schedules from financing contracts in the financing management module, the Fund Credit Management System provides early warnings for debt maturity and insufficient balances for principal and interest repayments. It also analyzes the scale and cost of interest-bearing debt from multiple dimensions, including financing channels and quality. The system can automatically calculate debt indicators monthly and implement early warnings when thresholds are exceeded. It monitors the group's debt risk situation, ensuring real-time, effective, and controllable oversight of the group's debt risk.

3.1.2 Financing Plan Control Model. The Fund Credit Management System enables strict oversight of financing demands and projects of each unit within the group. It establishes a dynamic financing control mechanism featuring annual financing demand planning and monthly rolling adjustments to financing plans. Units can submit and get approval for financing plans as needed, and the system facilitates the analysis, monitoring, and evaluation of financing plan execution.

3.1.3 Digital Cockpit Model. To reduce enterprise fund risk and optimize fund structure, the Fund Credit Management System features an advanced digital cockpit module. This module provides multi-dimensional chart analysis and visualization for account structures, account transactions, financing structures, financing balances, maturity status, and financing costs. It also performs statistical analysis of major quarterly risk events for real-time reporting to the provincial SASAC. The account information submodule is shown in Figure 7.

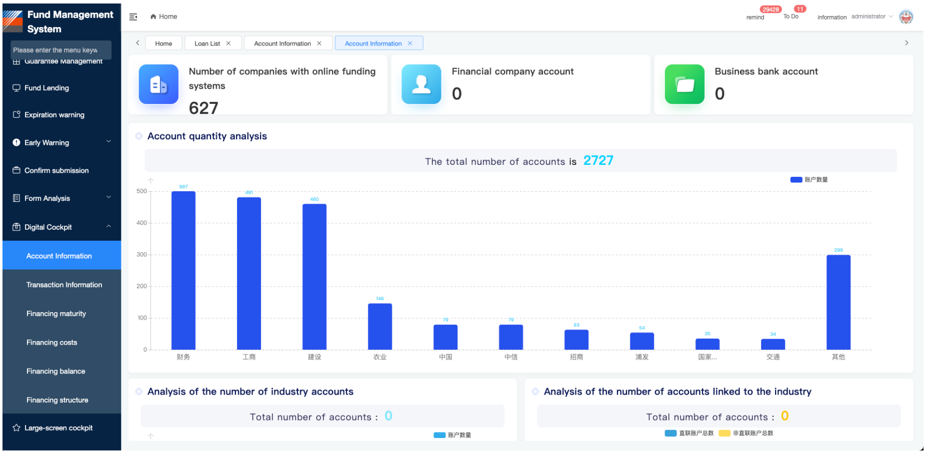

Fig. 7. Digital Cockpit - Account Information Submodule

The Fund Credit Management System utilizes large-screen displays to enable users to promptly track changes in fund data and indicators, identify abnormal fund management situations in a timely manner, and assist managers in making more informed fund decisions. The specific interface is shown in Figure 8.

Fig. 8. Large Screen of the Fund Credit Management System

4 Conclusion

4.1 Practicality

The Fund Credit Management System enhances the Group's fund management capabilities in four key aspects: First, it achieves centralized data management and control, with business operations made transparent and visible; Second, it rigorously prevents fund risks and builds internal control systems. Third, it strengthens centralized financing coordination and breaks down fund barriers. Fourth, by coordinating internal loans and external financing, it leverages scale advantages at all levels to maintain the Group's average financing costs at a low level.

4.2 Value

In early 2022, a certain SASAC initiated the construction of its financial risk monitoring platform, a key project of its "14th Five-Year Plan" for digital reform. A certain group company undertook the construction of the fund credit risk subsystem while concurrently establishing its own fund credit management system.

By October 2022, the Fund Credit Risk System was deployed at a certain SASAC and across all of its more than ten provincial state-owned enterprises. The Fund Management System for a certain group company was launched in nearly a thousand units within the group.

Since its launch, the system has been rolled out to nearly a thousand enterprises, serving close to two thousand users. It manages several thousand accounts, processes thousands of transactions daily, aggregates thousands of financing contracts, and oversees outstanding financing of nearly 100 billion yuan.'

In terms of risk alerts, the system generated over 12,000 warning notifications covering various scenarios such as account anomalies, insufficient fund pooling, and financing maturity risks, effectively mitigating liquidity risks and debt default risks.

The provincial Fund Credit Risk System has been implemented in more than a dozen provincial state-owned enterprises, monitoring about thousands of entities. It has collected data from tens of thousands of accounts and tens of thousands of financing contracts, enhancing the provincial SASAC's ability to manage enterprise fund risks, and enabling digital analysis and intelligent early warnings.

4.3 Scalability

Treasury management for large conglomerates is an ongoing, dynamic process[5]. The Fund Credit Management System has undergone multiple version updates, continuously adding new modules and functionalities, which has significantly improved the fund credit risk management capabilities of provincial state-owned enterprises.

At the end of 2023, in an innovation event for intelligent supervision business models hosted by the SASAC, the "Fund Credit Risk Management System" submitted by a certain group company and its subsidiary digital technology company won the "Outstanding Application Award". The system's documentation was included in a collection of excellent cases for intelligent supervision business models and will be deployed in the forthcoming "State-owned Assets Supervision Application Market." This enables units within the state-owned and central enterprise system to utilize it as needed. The treasury development of central state-owned enterprises should maximize fund returns and operational efficiency through continuous optimization of resource allocation, while reducing construction costs and enhancing application effectiveness through model innovation.

The Fund Credit Risk Management System has not only significantly enhanced capital utilization efficiency and credit risk control capabilities but also played a pivotal role in advancing refined management practices within state-owned enterprises and optimizing financial resource allocation. Particularly noteworthy is its highly scalable architecture design, enabling adaptation to evolving regulatory policies and market conditions. Whether facing business expansion, organizational restructuring, heightened external regulatory demands, or deepening market mechanisms, the system possesses the potential for flexible adaptation, ensuring long-term stable operation. Future exploration may integrate cutting-edge technologies like artificial intelligence and machine learning into the credit management system to enhance critical functions such as data mining, risk identification, and trend forecasting. By incorporating intelligent algorithms, the system will achieve higher levels of automation and intelligence, providing more precise and efficient support for state-owned enterprises in fund allocation and credit decision-making within complex economic environments. This will drive the continuous optimization and upgrading of the fund credit management framework.

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