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Research on Optimization Strategy of Comprehensive Budget Management in the Era of Big Data

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Keywords: Big Data Era; Comprehensive Budget Management; Optimization Strategy; Data Quality; Technology Application

Abstract: In the era of big data, the comprehensive budget management of enterprises is undergoing a brand-new transformation. This article deeply analyzes the characteristics of the era of big data and its impact on comprehensive budget management, and points out the challenges currently faced by comprehensive budget management in aspects such as data quality is uneven, and data security is difficult to guarantee, data processing technology is difficult to apply, and system compatibility is different, the organizational structure is not adaptable enough and lacks professional data analysis talents. This paper proposes targeted optimization strategies from multiple dimensions, including establishing standardized data standards, constructing a secure data management system, introducing advanced big data processing technologies, optimizing the budget management system, adjusting the organizational structure, and cultivating and introducing compound talents. Reasonable application of big data technology can significantly enhance the level of comprehensive budget management and help enterprises make precise decisions and operate efficiently in the complex and changing market environment.

1. Introduction

In today's era of rapid digital development, big data technology is penetrating all industries at an unprecedented pace, profoundly transforming corporate operational models and management philosophies. As one of the core tools in enterprise management, comprehensive budgeting plays a crucial role in optimizing resource allocation, implementing strategic goals, monitoring operations, and preventing risks [1]. However, traditional comprehensive budget management faces numerous challenges in the age of big data. The big data era brings new opportunities and transformative momentum to comprehensive budgeting. Big data technology enables real-time monitoring and dynamic adjustments of budget execution, promptly identifying and addressing deviations and issues during the budget implementation process, enhancing the company's risk response capabilities. It promotes information sharing and collaboration across departments, breaking down data silos, and improving the efficiency and effectiveness of comprehensive budget management.

2. Overview of big data era and comprehensive budget management

2.1 Characteristics and development trends of the era of big data

In the era of big data, data is experiencing explosive growth, with massive volumes being one of its most prominent features [2]. Data types are also diverse, encompassing network logs, audio, video, images, and geographic location information. This includes both structured data, such as corporate financial statements, and unstructured data, like user comments, images, and videos on social media, which are difficult to store and process in fixed formats. There is also semi-structured data, such as emails and web pages, which fall between the two. Data generation and processing are extremely fast, and in this age of rapid information dissemination, real-time data is constantly being generated [3]. The requirement for timeliness in data processing is very high, necessitating the collection, analysis, and feedback of data within a short period to support timely decision-making. Although the value density of data is relatively low, through powerful algorithms and data analysis techniques, valuable insights can be extracted from vast amounts of data, providing strong support for corporate decision-making and innovation.

Looking ahead, big data will be deeply integrated with technologies such as artificial intelligence and the Internet of Things.

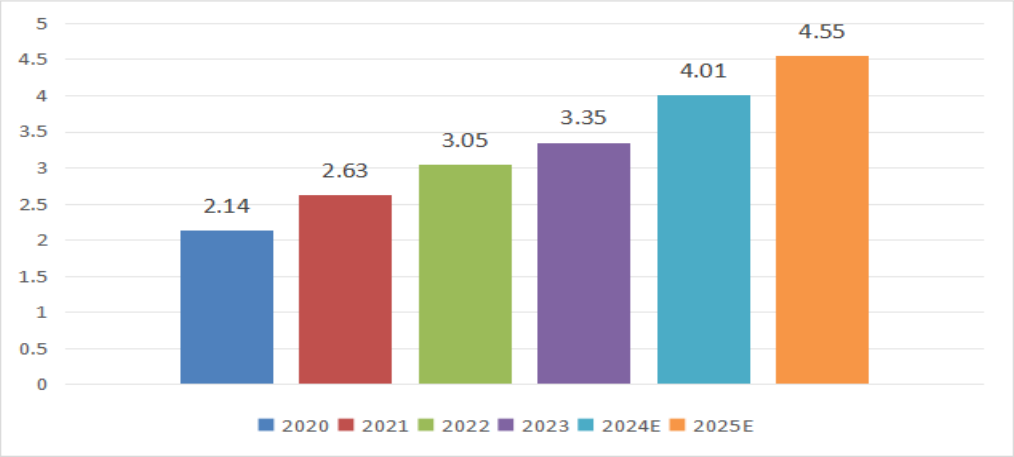

Figure 1: Size of China's Internet of Things market from 2020 to 2025 (unit: trillion yuan)

Data source: China Business Industry Research Institute released "2025-2030 China Internet of Things market demand forecast and development trend forward report"

In the field of IoT integration with industrial applications, as shown in Figure 1, the national IoT market size was approximately 3.35 trillion yuan in 2023, representing a year-on-year growth of 9.84%. Looking ahead, the potential for IoT growth is significant. Analysts from the China Business Industry Research Institute predict that the national IoT market size will reach 4.01 trillion yuan in 2024 and 4.55 trillion yuan in 2025. The volume of data is expected to increase exponentially, and the widespread adoption of edge computing will enable localized data processing, enhancing real-time performance.

2.2 The connotation and function of comprehensive budget management

Comprehensive budget management is a strategic goal-oriented approach that uses systematic methods to forecast and plan all production and business activities for a specific future period (usually not exceeding one year or an operating cycle) [4]. It involves allocating, evaluating, and controlling various financial and non-financial resources across different departments and units

within the company to effectively organize and coordinate production and business activities, thereby achieving predetermined operational goals. The content of comprehensive budget management includes operational budgets (business budgets), specialized decision-making budgets, and financial budgets. Operational budgets cover sales budgets, production budgets, procurement budgets, etc., which is quantitative plans for the company's daily operations; specialized decision-making budgets are prepared for major investment and financing decisions; financial budgets comprehensively reflect the results of all budgets in value form, including projected income statements, projected cash flow statements, and projected balance sheets.

Comprehensive budget management is of great significance to corporate operations. It serves as a crucial tool for implementing corporate strategies, breaking down strategic goals into specific budget indicators and assigning them to various departments and positions [5]. This ensures that all employees have a clear understanding of their work direction and objectives, facilitating the gradual realization of strategic goals. Comprehensive budget management effectively coordinates the work among different departments within the company, breaking down departmental barriers, promoting information sharing and collaborative cooperation, and preventing each department from operating in isolation, thereby enhancing overall operational efficiency.

2.3 The impact of big data on comprehensive budget management

In the budget preparation phase, big data provides a richer and more comprehensive data foundation. In the era of big data, companies can collect and integrate multi-source data from both internal and external sources [6]. This includes not only internal financial and business data but also market dynamics, industry data, competitor information, and macroeconomic data. By leveraging these vast amounts of data through data mining and analysis techniques, companies can more accurately predict market demand, sales trends, and cost changes, thereby formulating more realistic budget targets and plans. As shown in Figure 2, e-commerce companies can analyze massive user browsing and purchase data on their platforms, combined with market trends and competitors' pricing strategies, to more accurately forecast sales volumes and revenues for different product categories, thus reasonably preparing sales and procurement budgets.

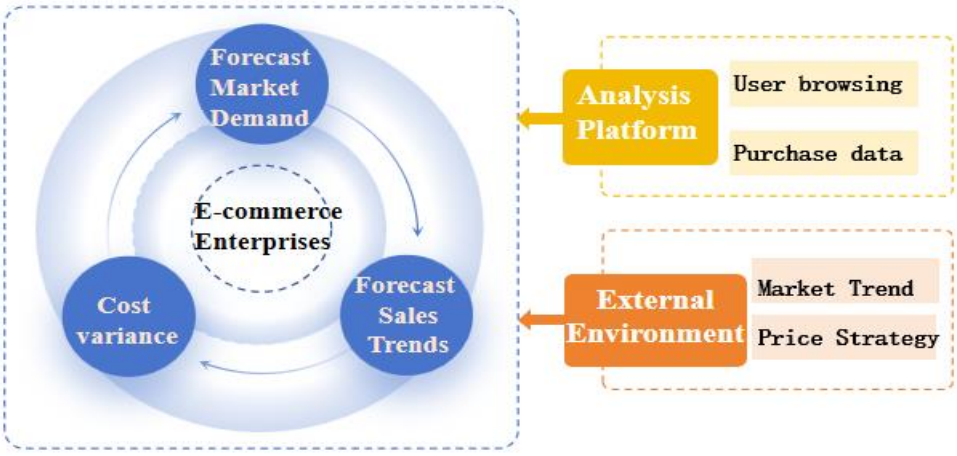

Figure 2: Massive data helps companies make accurate predictions

In terms of budget execution monitoring, big data has achieved real-time and dynamic capabilities. With the help of big data technology, companies can establish real-time budget execution monitoring systems to track and analyze the budget execution in a comprehensive and full-process manner. Once there is a deviation in budget execution, the system can immediately issue an alert, allowing management to take swift action for adjustments.

From the perspective of decision support, big data enhances the scientific and timely nature of decisions. The ultimate goal of comprehensive budget management is to support corporate decision-making and help companies achieve their strategic objectives [7]. Big data technology enables businesses to quickly process and analyze massive amounts of data, uncovering potential information and patterns behind the data, providing management with more comprehensive, in-depth, and accurate decision-making bases.

3. Challenges faced by comprehensive budget management in the era of big data

3.1 Data quality is uneven, and data security is difficult to guarantee

In the era of big data, data sources are extremely diverse. While the diversity of data sources provides rich information for comprehensive budget management, it also brings the challenge of uneven data quality [8]. Some data may contain missing values, such as key information not being collected in certain samples of market research; some data may have errors, like amount inaccuracies in financial data entry; and some data may be redundant, such as duplicate records of the same customer information across different business departments. These issues severely impact the usability of data and the accuracy of analysis results, thereby interfering with the scientific nature of budget preparation, execution monitoring, and decision-making analysis in comprehensive budget management.

Data security and privacy protection present another significant challenge for comprehensive budget management in the era of big data. Comprehensive budget management involves core financial data, strategic planning data, and critical business data from various departments within an enterprise. If this data is compromised, it could lead to the exposure of commercial secrets, loss of competitive advantages, and even legal risks.

3.2 Data processing technology is difficult to apply, and system compatibility is different

Big data processing technology is challenging to apply. Comprehensive budget management requires efficient handling and analysis of massive, multi-type data, which demands that companies have robust data storage, computing, and analytical capabilities. Emerging big data processing technologies, such as Hadoop and Spark distributed computing frameworks, can handle large-scale data but come with high technical barriers, requiring specialized personnel for deployment, maintenance, and development. When enterprises introduce these technologies, they may face difficulties in selecting the right technology. Different technology frameworks have varying application scenarios and advantages and disadvantages, and improper selection could lead to low system performance; during implementation, various technical challenges may also arise.

In the development process of enterprises, multiple information systems from different periods and vendors have often been established, such as financial management systems, sales management systems, and production management systems. However, due to differences in data formats, interface standards, and communication protocols among different systems, compatibility issues can easily arise during the integration process.

3.3 The organizational structure is not adaptable enough and lacks professional data analysis talents

The adaptability of organizational structures to big data budget management is a significant issue. In the era of big data, companies need to quickly acquire and process information to make timely decisions, which requires a flatter and more flexible organizational structure. However, when

adjusting their organizational structures, companies face numerous challenges, such as departmental conflicts of interest. Departments may worry about a reduction in their power and resources under the new structure, leading to resistance against organizational change; business process adjustments are difficult, as the new organizational structure may require redesigning business processes, involving a redivision of work methods and responsibilities across departments, making the implementation process complex and prone to confusion.

The shortage of professional data analysis talent severely hinders the application of big data in comprehensive budget management. In the era of big data, comprehensive budget management requires professionals who not only understand financial management but also possess data analysis skills and business acumen. Currently, such versatile talents are in short supply in the market. Most employees within companies are familiar with traditional budget management methods and lack specialized knowledge and skills in data analysis, making it difficult for them to effectively utilize big data technology for budget preparation, execution monitoring, and analytical decision-making.

4. Optimization strategies of comprehensive budget management in the era of big data

4.1 Establish standard data standards and build a secure data management system

Establishing unified and standardized data standards is the foundation for effectively applying big data in comprehensive budget management. Companies need to clarify the definitions, formats, coding rules, and collection frequencies of various types of data. In terms of sales data, it is essential to unify the statistical criteria and time periods for sales revenue and volume, stipulating that sales revenue should be based on actual received amounts, calculated on a monthly basis, to avoid inconsistencies caused by different statistical methods. Cost data standards should also be established, specifying the calculation methods and allocation principles for raw material costs, labor costs, and other expenses, ensuring the accuracy and comparability of cost data. By establishing these data standards, companies can effectively integrate internal and external multi-source data, providing reliable data support for budget management and enhancing the accuracy of budget preparation and analysis.

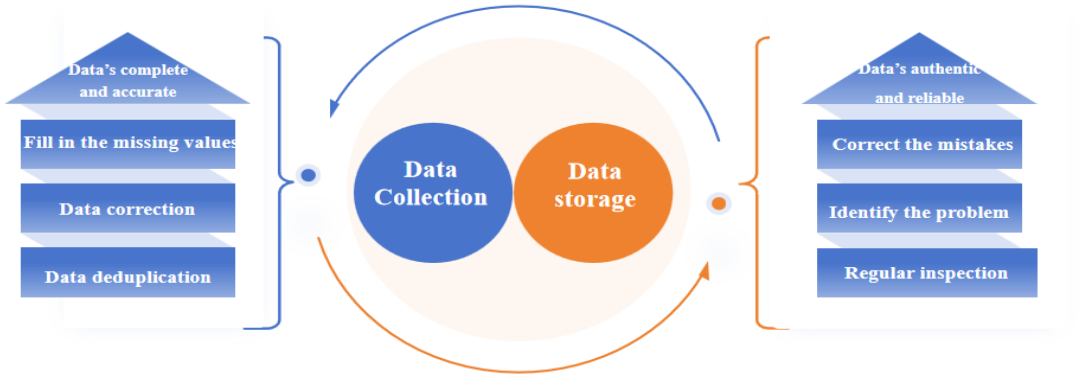

Figure 3: Establish a sound data quality monitoring system

Data quality directly impacts the effectiveness of comprehensive budget management, so it is essential to strengthen data quality control. As shown in Figure 3, companies should establish a robust data quality monitoring system. In the data collection phase, data cleaning techniques should be used to remove duplicates, correct errors, and fill missing values, ensuring the integrity and accuracy of the data. During the data storage phase, data validation tools should be employed to regularly check for consistency, promptly identifying and correcting data errors. Through data quality monitoring, companies can timely identify and address data quality issues, ensuring that the

data used in budget management is genuine and reliable. Additionally, establishing a data quality issue feedback mechanism allows for immediate notification to relevant departments when data quality problems are detected, enabling them to take corrective actions and hold individuals accountable for data quality, thereby enhancing awareness of data quality.

Building a secure data management system is crucial, as it concerns the core interests and operational safety of the enterprise. Companies must strengthen data security protection by adopting advanced network security technologies, such as firewalls, intrusion detection systems, and data encryption techniques, to prevent unauthorized access, theft, and tampering with data. Strict data access permissions should be set up, assigning appropriate data access levels based on employees' job responsibilities and business needs, ensuring that only authorized personnel can access and use sensitive data. Regular data backups should be conducted, storing important data across multiple geographic locations to prevent data loss due to hardware failures or natural disasters. Additionally, enhancing employee data security training, raising their awareness of data security, and standardizing their data operation behaviors can reduce data security risks caused by human factors.

4.2 Introduce advanced big data processing technology to optimize the budget management system

Introducing advanced big data processing technologies is key to enhancing the efficiency and effectiveness of comprehensive budget management. Hadoop Distributed File System (HDFS) can store massive amounts of data, with its distributed architecture offering high reliability and scalability, meeting the needs for large-scale data storage in enterprises. MapReduce The programming model provides parallel computing capabilities for big data processing, enabling rapid handling of vast datasets and improving data processing efficiency. Spark, based on in-memory computation, offers faster processing speeds and higher efficiency compared to traditional Hadoop MapReduce, capable of performing quick analysis and processing of real-time data. Enterprises can leverage these technologies to build big data processing platforms, achieving efficient storage, processing, and analysis of various types of data in comprehensive budget management.

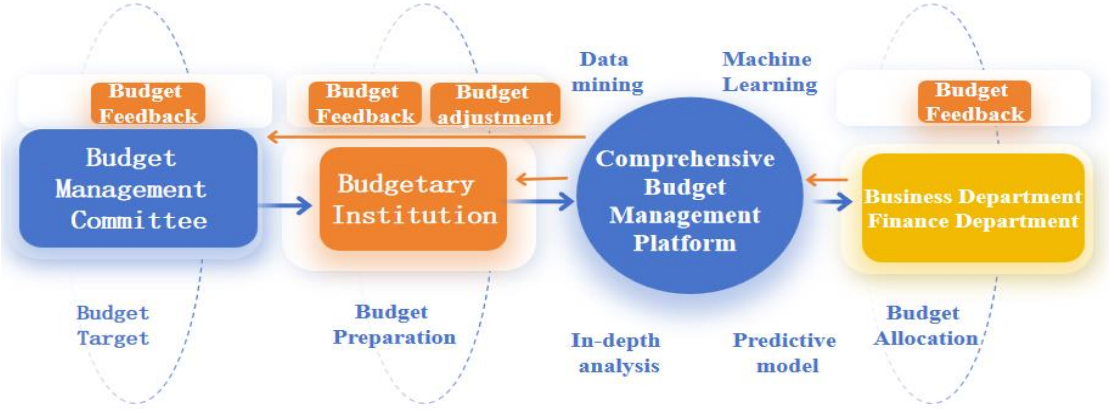

Figure 4: Deep integration of budget management system and big data technology

Optimize the budget management system to deeply integrate with big data technology, which can enhance the functionality and performance of the system. Companies should set reasonable budget targets based on their core business and corporate strategy. On the basis of big data, they can collect information and data from public cloud platforms in the same industry and related industries, and through comparative analysis, promptly determine the budget targets and management processes. Companies should foster an awareness of integrating big data with comprehensive budget management, treating it as a tool to improve efficiency and optimize resource allocation,

rather than leaving comprehensive budget management at the surface level of execution. As shown in Figure 4, the configuration of personnel in the budget management committee should be professional, with dedicated staff responsible for the group's comprehensive budget management. Upgrade and transform the existing budget management system to enable big data processing capabilities, ensuring seamless integration with the big data platform for real-time data transmission and sharing.

In the budget management system, integrate data mining and machine learning tools to conduct in-depth analysis of budget data. This article utilizes these tools to discover the underlying information and patterns behind the data, providing a more scientific basis for budget decisions. For example, in this paper, machine learning algorithms are applied to analyze historical sales data, establish sales forecasting models, predict future sales trends, and thereby prepare sales budgets more accurately.

4.3 Adjust the organizational structure and cultivate and introduce compound talents

To meet the demands of comprehensive budget management in the big data era, companies need to adjust their organizational structures. Enterprises reduce management levels, shorten the information transmission path, and ensure the rapid and accurate transmission of information within the company, thereby improving decision-making efficiency. Enterprises should establish dedicated data analysis teams or positions to be responsible for collecting, analyzing and applying big data, providing technical support and decision-making suggestions for comprehensive budget management. Enterprises enhance interdepartmental collaboration, establish cross-departmental budget management teams, and jointly participate in budget preparation, execution supervision, and analysis and decision-making. This promotes information sharing and business synergy across departments, enhancing the overall effectiveness of comprehensive budget management.

Cultivating and attracting versatile talent is key to promoting the application of big data in comprehensive budget management. Enterprises formulate systematic training plans based on the needs of different positions and strengthen the training of internal employees. Enterprises provide data analysis technology training to financial personnel, enabling them to master the use of data mining and analysis tools, and allowing them to apply data analysis technology to budget preparation and analysis. Enterprises provide training to business personnel in financial management and budget management to help them understand the involved processes and methods, enabling them to better participate in budget management. Enterprises actively recruit external professionals with knowledge and experience in big data analysis, financial management and budget management from universities, research institutions or other companies. This will enrich the company's talent pool and inject new vitality and innovative thinking into comprehensive budget management.

5. Conclusion and Prospect

Big data technology has brought unprecedented opportunities to comprehensive budget management. By providing rich data resources and powerful analytical capabilities, it effectively enhances the accuracy of budget preparation, the real-time monitoring of execution, and the scientific nature of decision support. Looking ahead, with the continuous development and integration of emerging technologies such as big data, artificial intelligence, and the Internet of Things, comprehensive budget management will exhibit trends towards intelligence, automation, and personalization. Budget management systems will be able to automatically collect, analyze, and process massive amounts of data, adjusting budget plans in real-time based on market changes and corporate operations, offering more precise and intelligent decision support to businesses.

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References

[1] Zhang Fang. Research on the Optimization Strategies of Group Comprehensive Budget Management from the Perspective of Business and Finance Integration [J]. Township Enterprise Guide, 2025, (06): 69-71.

[2] Liu Yan. Research on the Optimization of Financial Management Based on the Integration of Business and Finance--Taking M Enterprise as an Example [J]. Today's Fortune, 2025, (06):178-180.

[3] He Yanping. Research on the Optimization of Comprehensive Budget Management of Enterprises from the Perspective of Business and Finance Integration [J]. China Exhibition (China Conference), 2025, (04): 128-130. DOI:10.20130/j.cnki.1674-3598.2025.04.006.

[4] Xie Jinfeng. Research on enterprise comprehensive budget management based on business and finance integration [J]. Investment and Cooperation, 2025, (02): 99-101.

[5] Shu Qi. Innovation of Comprehensive Budget Management under the Financial Shared Service Model [J]. Taxation, 2025, 19(05): 112-114.

[6] Polzer T, Nolte I M, Seiwald J. Gender budgeting in public financial management: a literature review and research agenda[J]. International Review of Administrative Sciences, 2023, 89(2): 450-466.

[7] Indartini M, Herawati N R, Warnaningtyas H, et al. Behind the Low Level of Public Participation in local Budget Management: A Piece of the Story of Budgeting in Indonesia[J]. International Journal of Science and Management Studies (IJSMS), 2023: 41-47.

[8] Ekaningrum I R, Hadi N. The Role of Participatory Budgeting Management in Reducing the Budget Slack in an Islamic Education Institution[J]. QALAMUNA: Jurnal Pendidikan, Sosial, dan Agama, 2022, 14(2): 603-616.