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Enterprise Performance Management and Evaluation Incentive Model for Blockchain Technology and Big Data Algorithms

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Abstract: Blockchain technology and big data algorithms have new possibilities in the field of enterprise performance management. Blockchain is essentially immutable, and big data algorithms have the ability to conduct in-depth analysis, which makes it possible to establish a transparent and efficient performance management system. Aiming at blockchain technology and big data algorithm, this article proposed an enterprise performance management and evaluation incentive model. In terms of technical framework construction, this article designed decentralized performance management system architecture by using blockchain technology, and realized the automatic implementation of performance evaluation standards and reward distribution rules by using smart contracts. This article also added a random forest algorithm to enhance the function of the performance management system, and used big data analysis tools to analyze employee performance. The experimental results showed that the system performed well in management efficiency. The highest management efficiency of the system reached 99.2%. The response time of the system was between 302ms and 590ms, which showed that it had fast processing and analysis ability. In terms of evaluation model, compared with the mean square error of traditional model, random forest model made great improvement. Its maximum mean square error was 0.57, while the traditional model was 1.09. In addition, in terms of throughput, the random forest model reached 894 RPS, which was far from the traditional model. Therefore, for the incentive mechanism proposed in this article, the automatic and transparent effector of smart contract was used, which greatly improved efficiency and fairness.

1. Introduction

Enterprise performance management is one of the core corporate management activities, and

faces unprecedented challenges and opportunities, as the traditional performance management in enterprises is often manual operation and data storage centralized. This is not only inefficient, but also prone to data tampering and security risks. However, with the emergence of blockchain technology and big data algorithms, an innovative approach is provided to address these issues. Blockchain technology has decentralization, non-tamperable and transparent features, providing security and trust guarantees for the data, and supporting through large-scale data analysis capabilities of big data algorithms to provide more valuable insights and more enrich decision-making process optimization. The purpose of this article is to explore and propose a business performance management and evaluation incentive model that integrates blockchain technology and big data algorithm. The study not only designs a decentralized performance management system architecture based on blockchain, but also integrates big data algorithms to enhance the accuracy of performance analysis. In addition, this article verifies the significant advantages of the proposed model in management efficiency, system response time, evaluation accuracy, and data throughput through experiments.

This article introduces the research background, research objectives and contributions, as well as the overall structure of the article in the introduction section. The second part reviews the existing research in the field of enterprise performance management and summarizes the research achievements of previous scholars in performance management practices, challenges, and optimization strategies. The third part describes the design and implementation of an enterprise performance management and evaluation incentive model for blockchain technology and big data algorithms. The fourth part presents the experimental results and analyzes the system performance, performance evaluation model, and incentive mechanism effectiveness. Finally, the research findings are summarized; future research directions are proposed; the implications of this study for enterprise management practices are discussed.

2. Related Work

In order to understand the multidimensional impact of performance management, numerous scholars have conducted extensive research, exploring the practices, challenges, and optimization strategies of performance management in different industries and backgrounds. Pan Shujie analyzed the current situation of enterprise performance management, summarized the problems in four aspects of enterprise performance planning, data collection and processing, data integration and analysis processing, performance coaching, and application of assessment results, and proposed optimization strategies based on the problems. The aim was to provide ideas for scientific performance management work in enterprises, fully leverage the role of performance management, and provide guarantees for improving talent competitiveness in enterprises [1]. Yang Hongyu elaborated on the advantages of applying the Balanced Scorecard in performance management of property service enterprises, then briefly analyzed the current situation of performance management in property service enterprises, and finally explored the application plan of the Balanced Scorecard in performance management of property service enterprises [2]. Under the dual background of deepening the reform of state-owned enterprises and the downturn of the real estate industry, Hong Xiaomei provided reference for the upgrading of performance management in state-owned enterprises by analyzing the problems of performance management in state-owned enterprises and implementing optimization plans [3]. Huang Rui emphasized the importance of enterprise performance management in adapting to market changes by analyzing the changes in consumer demand for food [4]. Yang Qian elaborated on the positive impact of big data on performance management in state-owned enterprises, conducted research on current issues such as lack of awareness of performance management, low ability to analyze and apply data, and improper

performance evaluation, and proposed feasible optimization strategies [5].

Pinheiro P evaluated how market orientation, which has been regarded as an important predictor of corporate performance, affects social and economic performance in the social enterprise environment [6]. Khan R U studied the impact of entrepreneurial orientation on the financial and non-financial performance of small and medium-sized enterprises and the moderating effect of financing channels [7]. Berbegal-Mirabent J studied the relationship between the mission statement and performance of social enterprises. The research results indicated that companies whose mission statements explicitly consider customers and product/service offerings are more likely to exhibit higher economic performance [8]. Li Z briefly analyzed the current situation of employee performance management evaluation in manufacturing enterprises and proposed effective ways and ideas for institutional innovation [9]. Tuffour J K used structural equation modeling to analyze the data and investigated the impact of financial literacy (awareness, attitude, and knowledge) of managers on the performance of small businesses (financial and non-financial) in La Nkwantang Madina, Ghana [10]. Although the above studies provide profound insights into enterprise performance management and propose corresponding optimization strategies for different industries and backgrounds, their exploration of integrating emerging technologies, especially blockchain and big data algorithms, is still insufficient. This study proposed an enterprise performance management and evaluation incentive model for blockchain technology and big data algorithms. By exploring the transparency and immutability of blockchain, as well as the deep analysis capabilities of big data algorithms, this article designed an innovative performance management framework aimed at improving performance evaluation efficiency, enhancing employee motivation, and promoting the achievement of enterprise strategic goals.

3. Methods

3.1 Construction of Technical Framework

This article uses blockchain technology to develop a decentralized enterprise performance management system architecture, and uses its immutable characteristics to ensure the high transparency and security of employees' enterprise performance data [11-12]. In this framework, smart contracts automatically implement performance evaluation standards and incentive distribution rules, which reduces the need for manual intervention and enhances the efficiency and fairness of the whole process.

The integration method of random forest enhances the capability of performance management system under the background of combining performance management system with blockchain technology. The design includes defining the types of performance data to be collected, and designing an effective data collection process to ensure timely and accurate collection of performance data. The collected data is then imported into big data analysis tools, and the random forest algorithm processes the data by constructing multiple decision trees and conducts in-depth analysis of employee performance. Each decision tree is independently constructed, and during the training process, they randomly sample the dataset, including randomizing feature selection, to reduce model variance and improve overall prediction accuracy.

The ability to process large amounts of data and provide an evaluation of the importance of features is an advantage of the random forest algorithm, which helps identify which performance indicators affect the overall performance of employees. In addition, the integrated multiple decision trees make the model more robust to noise and outliers in the data, reducing the risk of overfitting.

3.2 Development of Performance Evaluation Model

The dimensions of enterprise performance include employee work results, work quality, teamwork, innovation ability, customer satisfaction, etc. This article refines these dimensions into specific and quantifiable indicators. For example, work results can be measured by project completion rate, and work quality can be evaluated by error rate or product qualification rate, as shown in Table 1:

Table 1: Employee performance dimension data

Employee ID	Department	Position	Project Completion Rate	Error Rate	Product Qualification Rate	Teamwork Score	Innovation Proposals	Customer Satisfaction	Performance Score
E12351	Customer Service	Customer Service Specialist	84%	1.8%	93%	6	2	8.7	79
E12352	Production	Production Supervisor	93%	0.3%	97%	7	4	9.6	90
E12353	R&D	Senior Developer	97%	0.2%	99%	9	6	9.8	95
E12354	Marketing	Marketing Analyst	87%	1.3%	91%	8	5	9.1	83
E12355	Logistics	Logistics Coordinator	80%	2.5%	89%	5	1	8.0	75
E12356	Administration	Administrative Assistant	78%	3.0%	88%	4	0	7.5	70

Table 1 presents the key information for evaluating the performance of company employees, with a focus on measuring their job performance. By using Table 1, the company can objectively evaluate the work performance of employees, while motivating them to improve work efficiency and quality, promoting consistency between employees and company goals and teamwork, helping management understand the performance trends of the entire organization or specific departments, and providing data support for the company's strategic planning and operational decisions.

Through random forest analysis, companies can gain insights into employee performance, including which factors have a significant impact on employee performance, and how to improve performance through incentive measures. In addition, random forests can also predict future performance trends of employees, helping management make forward-looking decisions, such as in employee training, career development path planning, or incentive policy formulation. Ultimately, the performance evaluation model integrates these analysis results, automatically generates performance reports, provides personalized feedback and development suggestions for employees, and provides strategic decision-making support for management.

3.3 Incentive Mechanism Design

This article proposes an innovative method that integrates blockchain technology and big data algorithms. By utilizing the decentralized nature of blockchain, this article ensures the security and integrity of employee performance data, providing a solid foundation for building trust and ensuring the immutability of data [13-14]. The application of smart contracts allows for automatic execution of performance evaluation standards and incentive allocation rules when preset performance conditions are met, reducing manual intervention and improving the efficiency and transparency of the entire performance management process.

This article uses the random forest algorithm for performance analysis, enabling the system to process and analyze a large amount of performance data, and identify trends and patterns in employee performance. The random forest algorithm processes data by constructing multiple decision trees, revealing complex relationships between different performance indicators,

identifying key driving factors, and predicting future job performance of employees, providing strong decision support for management.

When designing incentive mechanisms, this article closely combines incentive models with traditional performance evaluations to ensure that employee rewards are directly related to their performance. The application of smart contracts makes the incentive allocation process automated and transparent. Once the employee reaches the predetermined performance target, the smart contract can automatically trigger the corresponding reward distribution. This mechanism not only improves the efficiency of incentive allocation, but also ensures the fairness and transparency of the entire process.

3.4 System Implementation

Based on the characteristics of decentralization and immutability of data, blockchain technology provides a solid foundation for building a secure and transparent performance management system [15]. In this system, the development of smart contracts becomes the core, and these automatically executed contracts automatically evaluate employee performance and allocate incentives based on preset performance conditions, thereby reducing manual operations and improving process efficiency and fairness. At the same time, the system implements refined permission management to ensure that employees and management at different levels can only access corresponding data, and protects employee personal information and performance records through advanced data encryption technology.

The integration scheme of the random forest algorithm further enhances the functionality of the performance management system. This plan defines the types of performance data that need to be collected, including employee work hours, project completion, colleague and superior evaluations, and designs an efficient data collection process to ensure that this data can be captured in a timely and accurate manner. The collected data is then imported into big data analysis tools, and the random forest algorithm processes the data by constructing multiple decision trees and conducts in-depth analysis of employee performance. Each decision tree is independently constructed, and during the training process, they randomly sample the dataset, including randomizing feature selection, to reduce model variance and improve overall prediction accuracy. In terms of incentive mechanism design, this article ensures that employee rewards are directly related to their performance, and achieves automation and transparency in the incentive allocation process through the application of smart contracts.

4. Results and Discussion

4.1 System Performance Evaluation

The efficiency of performance management after the implementation of the system is reflected in several aspects. Firstly, the decentralized storage and automated execution of smart contracts achieved through blockchain technology significantly reduce manual operations in traditional performance management, such as data entry, calculation, and verification, thereby greatly improving the speed of data processing and overall management efficiency. Figure 1 shows the management efficiency of different enterprise systems after implementation.

Figure 1 shows the management efficiency of 20 different enterprises after implementing performance management systems, reaching a maximum of 99.2%. This not only highlights the potential of the system in improving management efficiency, but also reflects the feasibility of optimizing performance management processes through technological means.

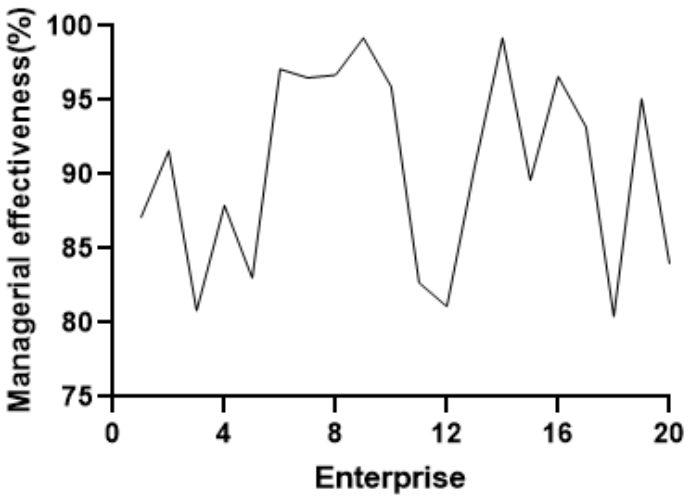

Figure 1: Enterprise management efficiency

Secondly, the real-time update and transparency of performance data ensure that management can timely obtain the latest performance information, make quick decisions, and thereby improve the response speed and decision-making quality of the enterprise. The enterprise response time is shown in Figure 2:

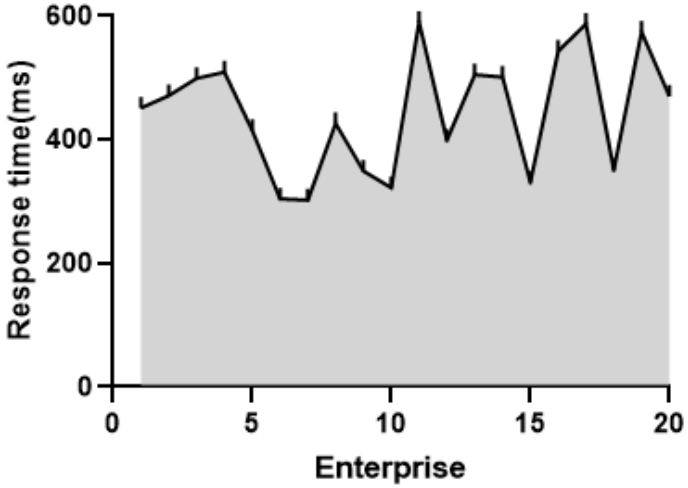

Figure 2: Response time

According to the data in Figure 2, the response time of 20 enterprises is between 302ms and 590ms, indicating that the system has the ability to quickly process and analyze data. When management needs to obtain employee performance data in real-time to make quick decisions, the rapid response of the system can provide necessary support.

In addition, system performance evaluation also includes usability testing of the user interface to ensure that employees and management can easily interact with the system, as well as testing of system response time to ensure that the system can quickly process and provide feedback on information. Performance evaluation should also include considerations of system scalability, verifying whether the system can smoothly upgrade with the expansion of enterprise scale.

4.2 Performance Evaluation Model

The performance evaluation model utilizes the immutability of blockchain to ensure data transparency and security, providing a solid foundation for performance data. On this basis, the automatic execution mechanism of smart contracts reduces manual intervention and improves the efficiency and fairness of the entire performance management process. Through meticulous permission management, the system ensures that employees and management at different levels can only access corresponding data, and protects employee personal information and performance records through advanced data encryption technology.

The random forest algorithm processes data by constructing multiple decision trees and conducts in-depth analysis of employee performance, revealing complex relationships between different performance indicators, identifying key driving factors, and predicting future job performance of employees. The advantage of this algorithm lies in its ability to process large amounts of data and provide an evaluation of feature importance, which helps identify which performance indicators have a significant impact on the overall performance of employees.

In the performance evaluation model proposed in this article, it is clarified that utilizing the immutability of blockchain technology and the automatic execution mechanism of smart contracts, as well as the application of random forest algorithm in big data analysis, has brought significant advantages to enterprise performance management. In order to further validate the performance of the proposed model, this paper designs and executes a series of comparative experiments to evaluate the performance of the random forest model in terms of mean square error and data throughput compared to traditional models.

The comparison results of mean square error are shown in Figure 3:

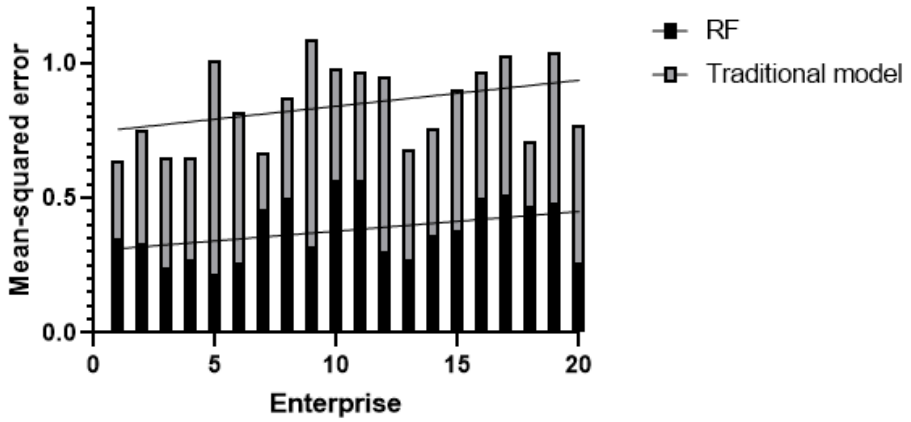

Figure 3: Mean square error

Figure 3 reveals the mean square error of the random forest (RF) performance evaluation model and the traditional performance evaluation model in different enterprises. The maximum mean square error of the random forest is 0.57, while the traditional performance evaluation model reaches a maximum of 1.09. This comparison emphasizes the advantages of random forest models in handling large amounts of heterogeneous data, especially when facing diverse performance evaluation standards and constantly changing business environments within enterprises. Random forest effectively reduces model errors by constructing multiple decision trees and integrating their results.

The comparison results of data throughput are shown in Figure 4:

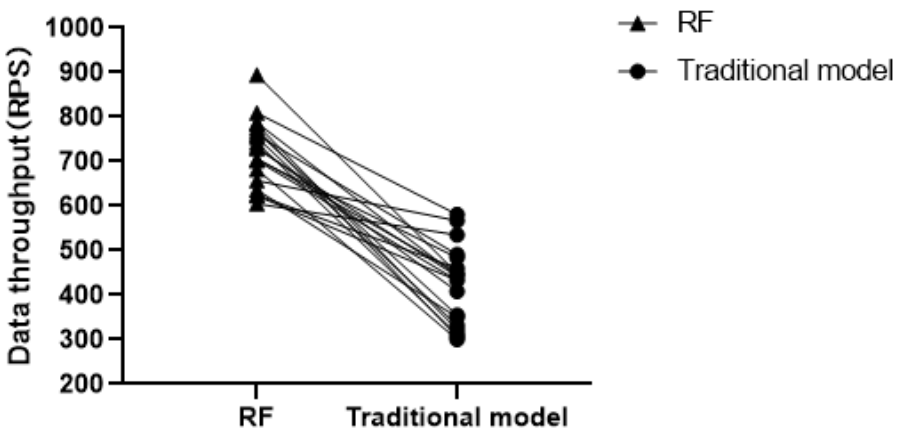

Figure 4: Throughput

According to Figure 4, the throughput of the random forest model is significantly higher than that of traditional performance evaluation models, with a maximum throughput of 894 RPS. This significant throughput advantage means that the random forest model can handle more performance evaluation transactions and still maintain efficient operation under high concurrency requests.

The performance evaluation model proposed in this article, through careful planning and execution of these key technologies and implementation details, can ensure efficient, transparent, and fair performance evaluation and incentive allocation, thereby improving employee motivation and overall performance of the enterprise.

4.3 Comprehensive Discussion

The advantages of technology integration are reflected in several key aspects: blockchain technology provides a secure, transparent, and tamper proof data storage solution; the use of smart contracts automates performance evaluation and incentive allocation processes, reduces human errors and processing time, and improves overall efficiency; the application of random forest algorithm enhances the system's ability to analyze complex data, providing accurate predictions and in-depth insights for performance evaluation.

However, there are also some shortcomings in the integration of technology. The complexity of technology may lead to high initial implementation costs and a learning curve. In addition, the integration of existing systems may face technical compatibility challenges and require additional adaptation work. Data privacy and security issues are also key concerns, and although blockchain provides advanced data protection, it must ensure the security of the entire system.

5. Conclusion

The enterprise performance management and evaluation incentive model based on blockchain technology and big data algorithms proposed in this article has been proven to have significant advantages in improving the efficiency, accuracy, and transparency of enterprise performance management through system design, implementation, and testing. By constructing a decentralized performance management system architecture and utilizing smart contracts to automatically perform performance evaluation and incentive allocation, manual intervention and improved process efficiency and fairness have been successfully reduced. At the same time, the fine permission management and data encryption technology implemented by the system ensure the security of employee personal information and performance records. In terms of incentive

mechanism design, the application of smart contracts ensures the automation and transparency of incentive allocation, improves the efficiency of incentive allocation, and ensures the fairness and transparency of the entire process. Although there are certain challenges in technology integration, such as implementation costs and learning curves, the advantages it brings are obvious in improving performance management efficiency, accuracy, and transparency.

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