

Retraction

Retracted: Construction Project Cost Management and Control System Based on Big Data

Mobile Information Systems

Received 31 October 2023; Accepted 31 October 2023; Published 1 November 2023

Copyright © 2023 Mobile Information Systems. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

- (1) Discrepancies in scope
- (2) Discrepancies in the description of the research reported
- (3) Discrepancies between the availability of data and the research described
- (4) Inappropriate citations
- (5) Incoherent, meaningless and/or irrelevant content included in the article
- (6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

- [1] S. Chen, "Construction Project Cost Management and Control System Based on Big Data," *Mobile Information Systems*, vol. 2022, Article ID 7908649, 7 pages, 2022.

Research Article

Construction Project Cost Management and Control System Based on Big Data

Siyu Chen 

School of Architecture and Civil Engineering, Xihua University, Chengdu 610039, Sichuan, China

Correspondence should be addressed to Siyu Chen; chensy@mail.xhu.edu.cn

Received 29 December 2021; Revised 18 January 2022; Accepted 27 January 2022; Published 18 February 2022

Academic Editor: Hasan Ali Khattak

Copyright © 2022 Siyu Chen. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

In today's society, engineering cost management and control is very important content. With the increasing number and scale of construction projects in China and huge investment funds, the collection and sorting of all kinds of information data in construction projects has become one of the problems that need to be solved. Therefore, building the construction project cost management and control system is one of the powerful means to improve the work efficiency of processing information and data, which is also very necessary. This paper mainly analyzes the construction of a perfect, efficient, and rapid processing of relevant information workflow based on large database technology to achieve the whole process of project tracking management and effective cost management and control target system. First of all, this paper introduces the construction project cost management, expounds the characteristics of the management system, and studies the application of big data in the construction project. On this basis, the construction project management software is designed and developed. At the same time, the requirements of the system are studied, and the system is tested. The final test results show that the system has a fast processing time and high processing efficiency in processing the above data, which indicates that the construction project cost management and control system based on big data has obvious advantages in processing large-scale data. When the amount of data is small, the processing speed increases exponentially with the increase of nodes. When the amount of data is large, the acceleration ratio is positively correlated with the number of nodes in a certain proportion. With the increase of nodes, the ratio almost remains unchanged, indicating that the system has high operation efficiency and is relatively stable with the increase of nodes.

1. Introduction

China is a populous country. With the development of economy and the continuous improvement of people's living standards, people put forward higher requirements for construction project cost management. In engineering construction, a large number of reliable data are needed to support investment decision making, design stage, construction process control, and other links [1, 2]. In the era of big data, construction project cost management and control has become the object of concern and attention of all walks of life in China. There are many complex and diverse characteristics in all links and stages of engineering projects. How to make effective use of these information resources is particularly important. Big data technology provides us with more colorful information resources and can effectively

avoid the problem of low efficiency caused by the traditional mode. At the same time, it also brings new challenges to the construction cost management. How to better and faster realize informatization and networking, and apply it to the whole life cycle of construction projects have become an important issue to be solved in engineering construction [3, 4].

Many scholars have studied the cost of construction projects. Some foreign developed countries have formed a relatively complete and mature system in terms of construction project cost management [5, 6]. They study how to effectively control construction project investment and improve investment efficiency from different angles, and put forward corresponding solutions and countermeasures. American scholars collect a lot of information and materials on the Internet to understand the construction of the

national engineering cost management and control system in the international market. Japanese scholars use network technology to establish a platform for a construction industry association to provide consulting services to its members in order to achieve the goal of reducing costs, improving benefits, and maximizing project value. Since the reform and opening up of China's engineering cost management and control, with the continuous improvement of economic and technological levels, engineering design, construction technology, and other aspects have been greatly improved. However, there are still many problems in the implementation of construction projects in China due to the imperfect construction market mechanism and the influence of institutional factors. Chinese scholars use the Internet and cloud computing technology to collect and process massive information, analyze and integrate it to provide strong support for investment decisions, and establish a set of database systems required by various industry institutions and government organizations to control risks scientifically and effectively. Big data technology is used to study the problems in project cost management to improve its competitiveness [7, 8]. The above research has laid the foundation for this paper.

With the development of the social economy, a large number of engineering cost information and management data have appeared in the investment field of construction projects in China. Therefore, how to effectively control the cost of construction projects has become an urgent problem. On the basis of large data, the whole process on the construction engineering construction stage and comprehensive dynamic monitoring system, and an analysis of deficiencies, this paper puts forward improvement measures and suggestions for reference, hoping to improve the level of enterprise of large database technology application so as to reduce the investment risk of the construction project, which is of great significance to promote the economic development of China.

2. Discussion on Construction Project Cost Management and Control System Based on Big Data

2.1. Construction Cost Management

2.1.1. Basic Principle. The construction project cost management and control under big data is mainly through the collection and sorting of various information in the project, and on this basis, the corresponding technical means are used to analyze and deal with the construction design changes or other related expenses. The basic principle of project cost management is to control the relationship among construction project investment, progress, and cost. In this process, we should follow the "separation of quantity and price," that is, by grouping all data information generated in the actual construction stage into one data source. Investment estimation is to use scientific and reasonable methods to calculate the total expenditure of construction projects according to the characteristics of construction projects and contract conditions. It includes three aspects:

first, technical and economic indicators; second, factors that are capital consumption and its balance rate; third, the influence degree and quantity of factors that are quality assurance measures on project cost control determine the cost, duration, and cost level of construction projects and the classification standard of high and low prices [9, 10]. Through the establishment of a comprehensive budget management system, the dynamic adjustment and optimization of the total cost expenditure and labor rate of the construction project are realized. According to the actual situation, the flexible precontrol method or the quota picking method is adopted to reasonably dispatch the material consumption on the construction site and timely feed back to the relevant departments for analysis and research so as to ensure the continuous improvement of the project cost management level.

2.1.2. Basic Principles

- (1) Adhere to the market orientation, information is collected and processed, and then conclusions are drawn through analysis, and the whole process of the construction project is considered comprehensively, including all stages of design, construction, and completion [11, 12]
- (2) On the premise of ensuring safety, the investment is reduced as much as possible so as to achieve the objectives of economic rationality and social harmonious development, and the characteristics of technical feasibility and maximizing cost investment benefits are taken into account so as to realize the overall control and optimal allocation of construction projects
- (3) We should make full use of advanced resources, improve efficiency, reduce the total cost expenditure, and save the occupation rate of limited funds as much as possible to provide reliable and efficient services for construction projects

2.2. Impact of Big Data on Construction Project Cost Management. In traditional construction projects, due to the lack of information collection and classification in the traditional mode, relevant personnel can only obtain corresponding data through on-site investigation, construction drawings, and other methods. However, in the investment decision-making stage of the construction project, there is no corresponding model to analyze the feasibility study and risk prediction of the project, and the lack of relevant technical support will also make it difficult to carry out the construction project cost management smoothly, and even problems cannot be solved. Information means cannot be well used in the project management. This affects the coordination and cooperation among all links in the whole construction project.

However, with the continuous development and maturity of modern information technology and network technology, these data can be mined, analyzed, and processed. Under the influence of big data, the project cost

management and control work is more scientific and reasonable. At the same time, it also provides more effective suggestions and opinions for decision makers for reference. For example, in the investment estimation, we should fully consider the feasibility of the engineering construction project and the rationality and scientificity of the cost standard, and also take countermeasures against the possible risks to avoid major losses. In the cost control and decision-making stage of construction projects, it is necessary to make a rapid response to market information and make a correct judgment. Design changes and contract signing can be completed through the bill of quantities, and the cost management department should feed back this information to the construction unit in time so that they can adjust and improve their work according to relevant conditions so as to realize the overall goal of the project.

2.3. Big Data Technology Support

2.3.1. Agnes Algorithm. Agnes algorithm is a dynamic stochastic optimization method based on probability distribution. In essence, it is a probabilistic statistical method, which takes the discretization, processing, and analysis of data as the working object and does not need any parameters in the calculation. It takes the input parameters as input variables and judges the problems existing in the system by calculating the expected output value and the actual output deviation. The model is mainly solved by PQI technology, lngf neural network, and other theoretical knowledge and mathematical analysis tools. The agnes algorithm continuously merges the two nearest clusters. The distance $f > k$ (R) to the two farthest points in the same cluster is the user-defined distance threshold. The distance metric used in the algorithm is the Euclidean distance. The algorithm can realize the computer automatic control function and can combine the cost of the whole project with the construction schedule to analyze the best design scheme. In the algorithm, the Euclidean distance between two samples O and P is

$$\text{dist}(o, p) = \sqrt{\sum_{s=0}^j (h_{as} - h_{js})^2}. \quad (1)$$

2.3.2. Mrrmr Algorithm. Mrrmr is a feature selection algorithm with minimum redundancy and maximum correlation. It is a calculation method based on engineering quantity. It takes the engineering construction project as the research object and collects and processes the project data by means of network technology, database management, and so on. By controlling the whole process of construction project cost management, a corresponding amount of information will be generated in each stage of the construction project. The evaluation function of the mrrmr feature selection algorithm is

$$f(d) = u(k, j) - \frac{6}{|u|} \sum_{\text{sec}} u(f, u). \quad (2)$$

The redundancy between the algorithm D and the feature subset u is determined by the correlation between the candidate feature D and the single selected feature u . The redundancy between D and u is calculated according to the average value.

2.3.3. Clustering Algorithm. The main difference between the clustering analysis algorithm and traditional classification learning is that the samples of the traditional clustering analysis method cannot be labeled but need to be determined adaptively by the clustering algorithm. Therefore, the cluster analysis algorithm is also one of the main objectives of resource data mining. Its essence is to explore how to divide samples into several types without training. In the process of project construction, cluster analysis is carried out for each region, which is divided into the same category according to different characteristic indexes. In this way, you can get objects with the same properties and types. The clustering algorithm is highly scalable and can process a large number of data, find all types of clustering, and deal with abnormal data and classification results. This makes it an indispensable technical medium in the field of data mining technology.

$$\begin{aligned} G_1 \cup G_2 \cup G_3 \cup \dots \cup G_n &= X, \\ G_i \cap G_j &= \emptyset, i \neq j. \end{aligned} \quad (3)$$

The input value of cluster analysis can be represented by an ordinal pair (x, s) or (x, f) , where x represents a group of samples, and s and f represent the criteria for measuring the similarity or dissimilarity (distance) between samples.

3. Experiment

3.1. Framework of Construction Project Cost Management System. With the rapid development of network technology and information technology, more and more project management software has been applied to the construction cost. The engineering information management system based on the big data platform is also constantly improving. As can be seen from Figure 1, the system is divided into three parts: project contract management, project cost statistics, and rapid estimation query. In these three parts, project cost statistics is the core, including project cost index analysis, bill of quantities query, and the comparative analysis of project cost index. All the contents required to be calculated in the project design and construction stage shall be provided by the construction unit. During the bidding of the project, the bidder can determine the quotation according to its own project budget, on-site management, market survey, and other data, and it will also make corresponding adjustments to the prices of some materials and equipment. These costs are quantified through the big data system and then fed back to the owner and the contractor.

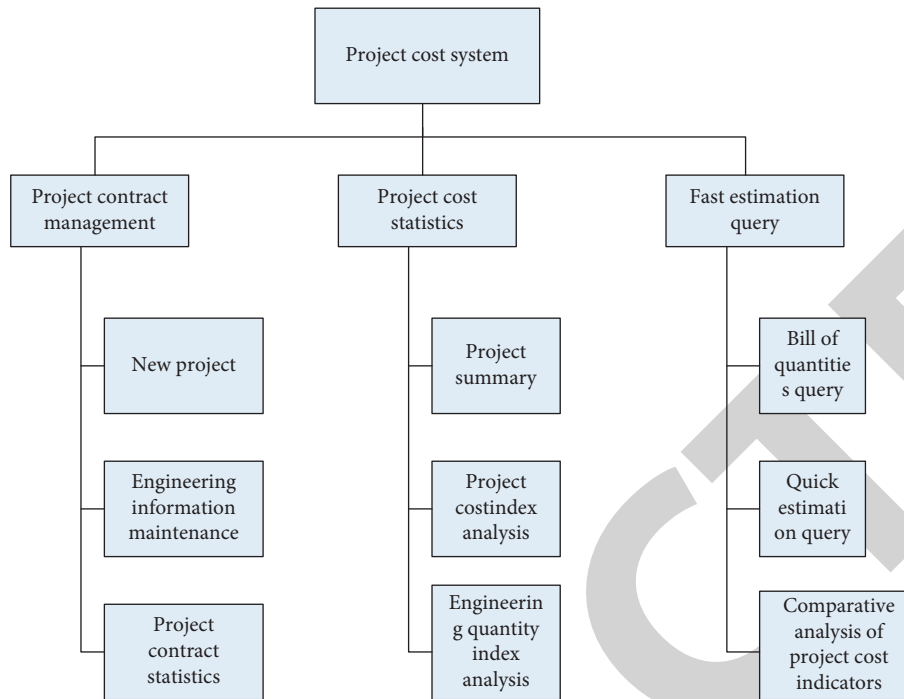


FIGURE 1: Construction project cost management system framework.

3.2. System Requirement Analysis

3.2.1. *Hardware Requirements.* Hardware requirements of the server are as follows:

- (1) Processor: Intel (AMD) dual core or quad core 2G or higher
- (2) Hard disk: 320G minimum, 1 t recommended
- (3) Storage: 2G, 4G recommended
- (4) Durability: 6×24 hour continuous operation must be observed

Customer's material requirements are as follows:

- (1) CPU: 1.8 g or higher
- (2) Storage: 512 M minimum, 1 g recommended
- (3) Hard disk: at least 80 g, 160 g recommended
- (4) Durability: it can meet the daily work

3.2.2. *Software Requirements.* Server software requirements are as follows:

- (1) Operating system: server version Windows2003 or windows2008
- (2) Service software: the operating system comes with IIS6 0
- (3) Database software: SQL Server 2005 or later
- (4) Infrastructure services: Net FrameWork3. 0

Client software requirements are as follows:

- (1) Operating system: Windows XP or Windows Vista

- (2) Browser: IE7 or higher, Firefox or chrome is recommended

3.3. *Construction Cost Data Mining Source Data.* Data warehouse or data mart is designed according to the mining theme of the project cost. There are generally two kinds of design patterns, star pattern and snowflake pattern. After selecting the mode, the fact table and dimension code table are designed according to the theme you want. A relational database is created for exploration topics. The database is not a database for transaction processing but a data store that prepares source data for mining topics. After creating the database, it will create the corresponding tables according to the designed fact table and dimension code table, and create the associated index. Data transformation services are used to extract, transform, and load relevant data scattered in different business databases, and they are collected and standardized into fact tables. In addition to importing and exporting data, DTS can also create software packages according to extraction requirements to realize the transformation and loading of heterogeneous data. Triggers can be used to insert new data records in the business system into the data mart fact table in time. In addition, DTS also provides the ability to load data periodically, allowing data to be loaded into the data store when the business database is not busy. When customers build a mining model, they must first connect the PivotTable service to the data mining model in the analysis service. This connection can be made through the local OLEDB provider. For example, ADO can also be implemented on the Internet using HTTP. When using the PivotTable service to connect to analysis, the role between

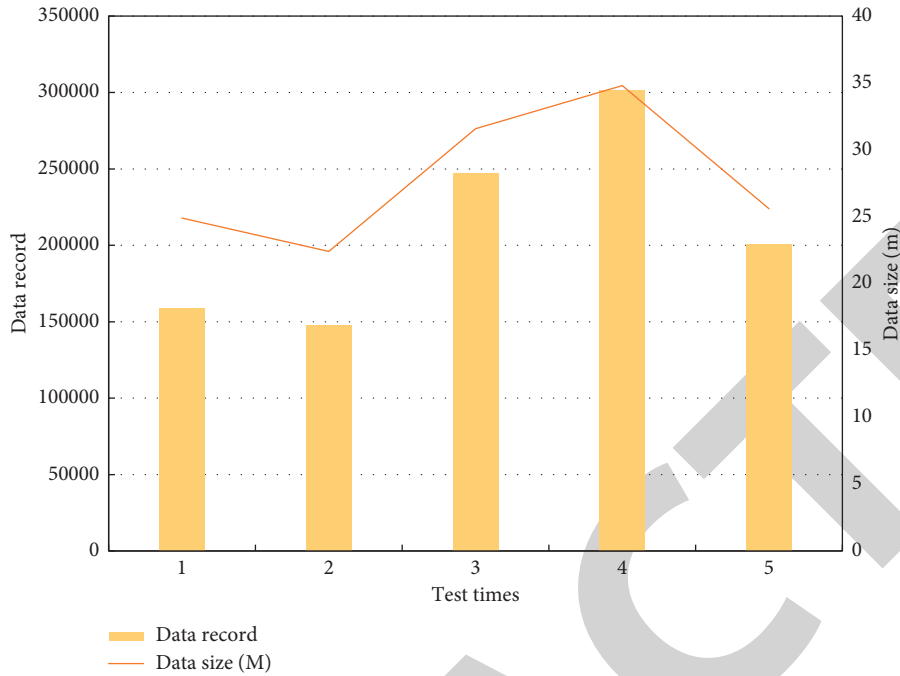


FIGURE 2: Information comparison of the test data.

TABLE 1: Data information.

Test times	Data record	Data size (M)
1	158,600	24.9
2	147,863	22.4
3	247,103	31.58
4	301,488	34.8
5	200,358	25.6

TABLE 2: Performance period.

Test serial number	Data record recording	Data size (M)	M (ms)	N (ms)
1	158,600	24.9	152	1247
2	147,863	22.4	1458	1241
3	247,103	31.58	1785	1458
4	301,488	34.8	2024	2456
5	200,358	25.6	1412	1478

them is greatly simplified in the data mining model in the service. Because the order of all AC alphabetic protocols and cache management is invisible to the client. Using the URL as the link, with the help of the data source function, you can use the relevant port to establish a direct connection with the scanning service through the firewall through the Internet. This connection can be established through a special mso-lap.asp web page from active server pages, and the URL can be used as the data source to connect to the standard subnet in the form of ADO.

3.4. Test of Construction Project Cost Management Control System. In the whole process of project implementation, we should constantly find and solve problems in order to make the project cost management more scientific. Therefore, we need to test the big data system to verify its function and performance. (1) Test objective: the application and integration degree, reliability and security of big data technology are evaluated. (2) Method selection and use principle: it can ensure that the design drawings can accurately run in the process of putting them into use after completion. Then, it

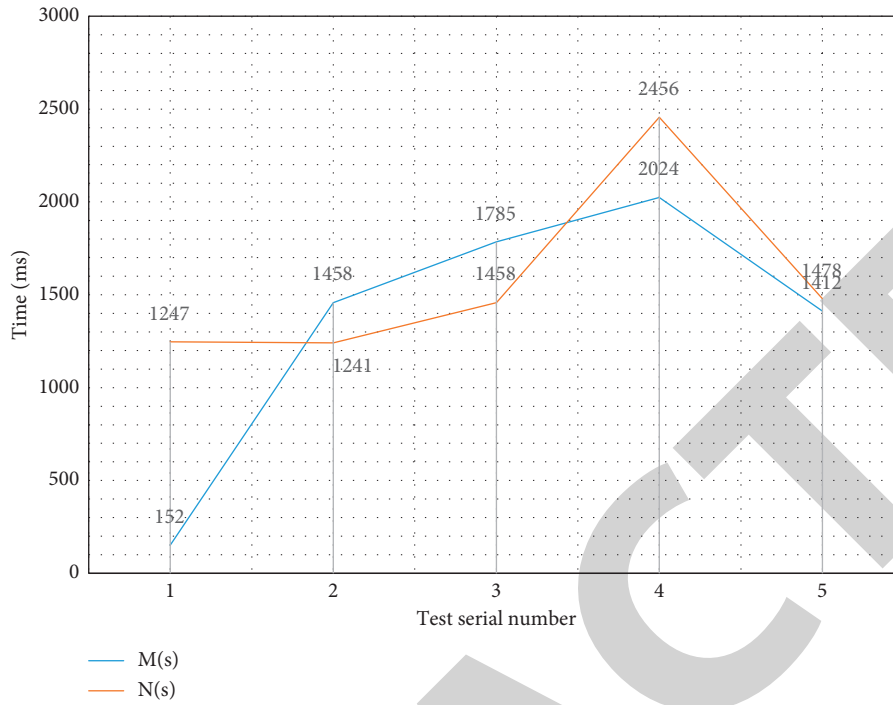


FIGURE 3: System frame runtime.

TABLE 3: System acceleration ratio.

Test serial number	Data record recording	Data size (M)	Number of nodes	Speed-up ratio
1	158,600	24.9	2	2
2	147,863	22.4	3	4
3	247,103	31.58	4	9
4	301,488	34.8	5	14
5	200,358	25.6	6	21

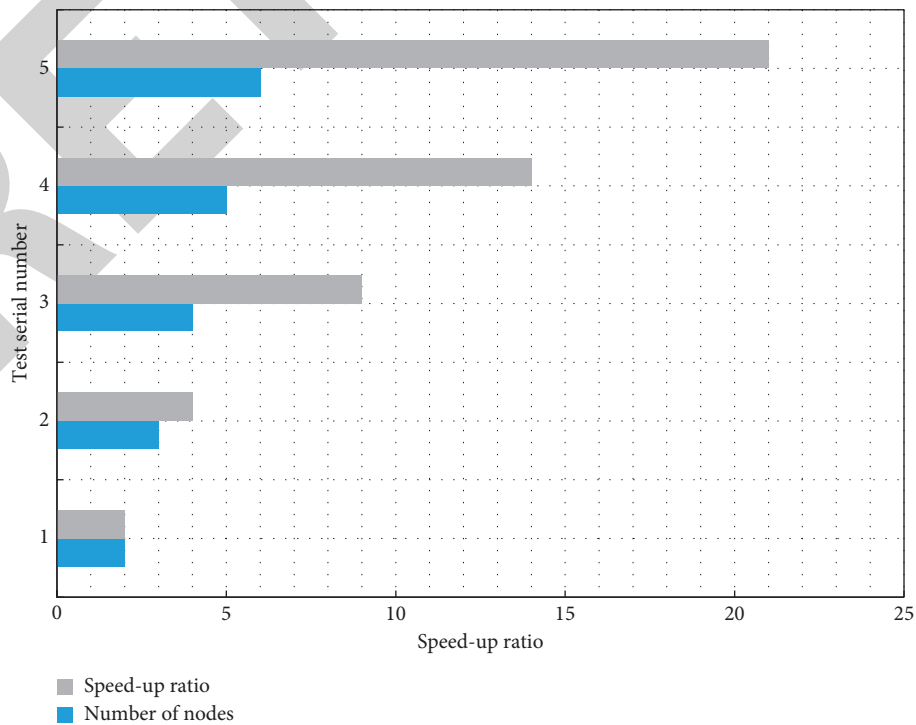


FIGURE 4: Acceleration ratio test comparison.

can also ensure that the project cost management system can effectively support the whole project implementation process.

4. Discussion

4.1. System Performance Test Data. In this paper, five groups of data are selected in the test process, and Figure 2 shows the data size of the test data. In the big data analysis, we must first have a detailed understanding of the information, data, and technology of the project cost so that they can make a correct judgment. The second is to collect data. We can use the database on the network or some platforms to obtain the materials used in the process of project construction. After sorting out these materials, we can get complete and accurate price information. Table 1 shows the information comparison of the test data.

4.2. System Framework Running Time. Table 2 is the comparison table of the running time of the system framework.

In the operation process of the whole big data system, the first thing to do is time control. Because, the project cost management and control system is interrelated, interactive, and influential. Therefore, we must determine the completion time and task amount of relevant work according to the actual situation and then obtain the relevant construction cost information through the analysis of the work flowchart of each stage. As can be seen from Figure 3, the system has a fast processing time and high processing efficiency in processing the above data, which shows that the construction project cost management and control system based on big data has obvious advantages in processing large-scale data.

4.3. System Acceleration Ratio Analysis. Table 3 shows the ratio of the amount of data to the time used by the system framework in the process of processing big data.

In the application of big data, a large amount of information needs to be processed, and this information is very complex, and there is a certain time interval between them. Through the analysis and utilization of big data technology, the efficiency of project cost management can be effectively improved. As can be seen from Figure 4, when the amount of data is small, the processing speed increases exponentially with the increase of nodes. When the amount of data is large, the acceleration ratio is positively correlated with the number of nodes in a certain proportion. With the continuous increase of nodes, the proportion remains almost unchanged, which shows that the system operation efficiency is high and relatively stable with the increase of nodes.

5. Conclusion

With the continuous development of China's market economy, the level of project cost management plays a more and more important role in construction projects, and big data technology is gradually applied to the construction

process of construction projects. This paper proposes to establish a set of scientific, effective, and in line with the needs of national conditions based on the large database, and controls the investment decision-making workflow and software system to solve the above problems so as to improve the economic benefits of the project and promote the sustainable development of the enterprise.

Data Availability

The data underlying the results presented in the study are available within the manuscript.

Conflicts of Interest

The authors declare that there are no potential conflicts of interest.

References

- [1] L. Xu, C. Jiang, J. Wang, J. Yuan, and Y. Ren, "Information security in big data: Privacy and data mining[J]," *IEEE Access*, vol. 2, no. 2, pp. 1149–1176, 2017.
- [2] Y. Zhang, M. Qiu, C.-W. Tsai, M. M. Hassan, and A. Alamri, "Healthcare cyber-physical system Assisted by cloud and big data[J]," *IEEE Systems Journal*, vol. 11, no. 1, pp. 88–95, 2017.
- [3] U. Sivarajah, M. M. Kamal, Z. Irani, and V. Weerakkody, "Critical analysis of Big Data challenges and analytical methods[J]," *Journal of Business Research*, vol. 70, pp. 263–286, 2017.
- [4] S. F. Wamba, A. Gunasekaran, S. Akter, S. J.-f Ren, R. Dubey, and S. J. Childe, "Big data analytics and firm performance: effects of dynamic capabilities[J]," *Journal of Business Research*, vol. 70, pp. 356–365, 2017.
- [5] A. Barbu, Y. She, L. Ding, and G. Gramajo, "Feature selection with annealing for computer vision and big data learning[J]," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 39, no. 2, pp. 272–286, 2017.
- [6] W. Xu, H. Zhou, N. Cheng et al., "Internet of vehicles in big data era[J]," *IEEE/CAA Journal of Automatica Sinica*, vol. 5, no. 1, pp. 19–35, 2018.
- [7] Y. Zhang, J. Ren, J. Liu, C. Xu, H. Guo, and Y. Liu, "A survey on emerging computing paradigms for big data[J]," *Chinese Journal of Electronics*, vol. 26, no. 1, pp. 1–12, 2017.
- [8] A. Kusiak, "Smart manufacturing must embrace big data[J]," *Nature*, vol. 544, no. 7648, pp. 23–25, 2017.
- [9] Y. . Zheng, "Urban computing: enabling urban intelligence with big data[J]," *Frontiers of Computer Science*, vol. 11, no. 1, pp. 1–3, 2017.
- [10] M. Rathore, A. Paul, A. Ahmad, B.-W. Chen, B. Huang, and W. Ji, "Real-time big data analytical architecture for remote sensing application[J]," *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, vol. 8, no. 10, pp. 4610–4621, 2017.
- [11] H. Xing, A. Qian, R. C. Qiu, W. Huang, L. Piao, and H. Liu, "A big data architecture design for smart grids based on random matrix theory[J]," *IEEE Transactions on Smart Grid*, vol. 8, no. 2, pp. 674–686, 2017.
- [12] Y. Wang, L. A. Kung, and T. A. Byrd, "Big data analytics: understanding its capabilities and potential benefits for healthcare organizations[J]," *Technological Forecasting and Social Change*, vol. 126, no. JAN., pp. 3–13, 2018.