IOT FINANCIAL MANAGEMENT SYSTEM FOR ENERGY ENTERPRISE MANAGEMENT RISK AND PREVENTION AND CONTROL STRATEGY UNDER THE BACKGROUND OF DOUBLE CARBON

Rui Cui*

School of Economics, Jiangsu University of Technology, Changzhou, Jiangsu, 213001, China.

cuirui0622@126.com

Reception: 02/02/2023 **Acceptance**: 13/04/2023 **Publication**: 28/06/2023

Suggested citation:

Cui, R. (2023). **IOT financial management system for energy enterprise management risk and prevention and control strategy under the background of double carbon**. *3C Empresa. Investigación y pensamiento crítico, 12(2)*, 144-159. https://doi.org/10.17993/3cemp.2023.120252.144-159

ABSTRACT

Despite the absolute number of developments and products of enterprise management systems and platforms, there are still limited ways to achieve risk assessment of enterprise financial management by energy enterprise stakeholders. To reduce the financial management pressure of energy enterprises as well as to reduce enterprise financial risks, this paper establishes an Internet of Things(IOT) financial management system. The system was also comprehensively evaluated based on the financial risk management status of each company for the period 2016-2020. The results show that a significant increase in the share of non-current liabilities was observed after the introduction of the IOT-based financial management system in 2018. Relative to the 2017 data, the current liability ratio decreased by 2.96%, 7.98%, and 14.59% for 2018, 2019, and 2020, respectively. The ratio of corporate investments to revenue decreased by 8.74%, 22.91% and 16.83%, respectively. Investments as a percentage of earnings decreased by 6.22%, 5.48%, and 6.82%, respectively. The ratio of undistributed earnings decreased by 9.69%, 18.82% and 35.39%, respectively. Finally, the introduction of the IOT's financial management system reduced financial management costs by a factor of 2.822, 4.358 and 5.501, respectively. And the cost of managing people in an integrated manner was reduced by 2.964, 3.012 and 4.004 times respectively.

KEYWORDS

IOT engineering; financial management; low-carbon energy; risk assessment; carbon daub

INDEX

https://doi.org/10.17993/3cemp.2023.120252.144-159

1. INTRODUCTION

Global climate change has led to sea level rise and frequent extreme weather disasters on Earth [1-2]. Biodiversity is severely affected, and global climate change has brought serious adverse impacts to human society [3-4]. More importantly, many of the adverse effects are already frequently visible and the situation is becoming increasingly critical [5]. Recent disasters such as extreme droughts and persistent forest fires due to superheated temperatures in North America, persistent heavy rains and floods in Western European countries, persistent heavy rains in many parts of northern China, and other natural disasters are most likely related to global climate change [6-7]. To actively respond to climate change, China has explicitly proposed the strategic goal of carbon peaking and carbon neutrality [8]. Carbon peaking and carbon neutrality will change China's energy and industrial structure, reducing the share of high consumption, high input, and high pollution industries [9-10]. Rather than simply sacrificing economic growth and national wealth accumulation, carbon peaking and carbon neutrality will lead to a comprehensive, coordinated, sustainable and high-quality development under carbon emission reduction constraints. The investment in "dual carbon" is both an expense and an opportunity for economic transformation and development [11]. The economic development mode will also shift to a green and sustainable development model. All activities of human society have been inseparable from energy, from clothing, food, housing and transportation to culture and entertainment, all of which consume a certain amount of energy directly or indirectly [12]. Energy is the material basis for the survival and development of human society [13]. Energy is the blood of industrial development, which drives the operation of industry-. Therefore, it is essential to achieve the goal of carbon peaking and carbon neutrality in a way that will affect the development of energy companies.

Energy as a strategic resource has a particularly important position in global economic development and has a wide and far-reaching impact on many aspects of international politics, military, science and technology [15-22]. China is not only a major energy producer but also a major consumer in the world, and with the rapid development of the Chinese economy, it is facing enormous pressure in terms of energy demand [23]. Especially under carbon-peaking and carbon-neutral policies, China's energy development model needs to be adjusted accordingly. The study of the interrelationship between the economic growth of energy companies, financial risks and the implementation of the carbon peaking policy is an important guide for the development of the national economy. Lu, S. [24] conducted an in-depth study on the impact of carbon peaking policy on energy funds, using a sample of 231 energy funds in China between 2008 and 2019, and examined the effect of carbon peaking policy on the network herding effect of energy funds as measured by hybrid network centrality, as well as the herding effect on profitability and stability. The results show that the network herding effect has a positive impact on the short-term profitability and risk-resilience of energy funds. However, the network herding effect reverses when long-term stability is tested. On the contrary, it can trigger greater systemic risks. Li, T. 25] evaluated the environmental performance of thermal power enterprises by

https://doi.org/10.17993/3cemp.2023.120252.144-159

considering peak carbon. They constructed an index system that comprehensively considered the whole process of environmental management of power generation enterprises and the factors affecting the environment. The environmental performance of thermal power enterprises was evaluated comprehensively by factor analysis, and then comparability of the environmental performance of power generation enterprises was achieved. This study enables timely, accurate, and comprehensive monitoring by stakeholders such as the government and the public. Cui, X 26] proposed an energy consumption prediction model based on an improved whale algorithm to optimize a linear support vector regression machine. The model combines multiple optimization methods to overcome the shortcomings of traditional models. They used the model to forecast the improvement of China's energy consumption under the peak carbon target. The results concluded that China needs to adjust its current policies to achieve the peak carbon target. Lin, J. [27] developed a three-level economic-environmental-behavioral demand response model for incentive price setting. Their model extends the analysis beyond the traditional disciplines of economic entities and incorporates new customer psychological cues. The findings suggest that through a reasonable carbon price, demand response models can be an effective tool to improve energy efficiency and decarbonization. Chen, J. [28] argued that the energy supply and demand model for China includes a planned peak scenario and an advanced peak scenario, which are designed by taking into account China's economic development, technological progress, policies, resources, and environmental capacity. In addition, they argue that decarbonization will become a fundamental feature of the structural change in energy supply and demand. The realization of the carbon peak requires the joint efforts of all industries. However, based on carbon peak realization, we need to consider the development of energy companies. With the promotion of the smart city concept, every industry in the city needs to become smarter. Ban, Y. [29] proposed an energy management system that can be used to monitor energy consumption in real-time, keep track of the company's energy consumption, and allocate the company's energy consumption. They developed two functions in the energy management system, energy allocation and energy consumption prediction, so energy companies can get better production plans, reduce their energy consumption, and improve their competitiveness. Considering the physical limitations of different energy networks, Mirzaei, M.A. [30] proposed a new entity called Multi-Energy Distribution Company. They argue that multi-energy storage systems and integrated demand response are considered to increase the flexibility of multi-energy distribution companies to serve multiple energy demands. Wang, L. [31] analyzed supply chain financing and blockchain technology for energy companies based on theoretical studies. They analyzed the management system, cash flow, and risk control system of the supply chain in the context of the current specifics of blockchain in supply chain financing. The results show that the supply chain financing parties of energy enterprises can optimize the supply chain financing risk control system while reducing business costs and improving enterprise efficiency, which greatly reduces the risk of the supply chain financing parties of energy enterprises and thus improves the competitiveness of enterprises. Zhang, X. [32] argues that effective financial management of prepayment is an important option for service providers and customers' financial IoT. They propose

https://doi.org/10.17993/3cemp.2023.120252.144-159

a scalable accounting solution where each user where the hosting user is located occupies a prepaid account that forms part of an embedded system, thus better serving each financial customer and reducing financial risk. From the above analysis, we can see that the realization of the carbon peak requires the joint efforts of all industries. The implementation of the peak carbon policy has a significant impact on the economic profitability of energy companies and the structure of energy sales. Therefore, in the context of the carbon peak, energy companies need to be prepared in advance for the arrival of financial risks and to do a good job of prevention and control.

The financial management risks and prevention and control of energy enterprises need to control and manage the financial risks and financial crises that may occur in advance. The traditional financial risk and financial crisis control and management methods have some shortcomings, such as low efficiency, slow speed, high accuracy and so on. Therefore, in this study, we introduce the Internet of Things financial management system to unify the management and prevention of financial management risks of energy enterprises. It focuses on the financial management of energy enterprises, financial risk assessment of energy enterprises, financial statistical statements of energy enterprises, basic financial data of energy enterprises, financial query of energy enterprises and protection of financial management system of energy enterprises. We hope our research can contribute to reducing the financial risks of energy enterprises and improving the core competitiveness of energy enterprises in the context of the carbon peak.

2. OVERVIEW OF THE INTERNET OF THINGS (IOT) FINANCIAL MANAGEMENT SYSTEM

With the increasing complexity of the financial management of energy enterprises, this study provides unified management of energy enterprise finance by enterprises and institutions through IOT financial management system. IOT financial management system is a study of risk and prevention and control strategies of energy enterprise financial management based on the background of Carbon Dafeng and the comprehensive use of modern information technology, and there are unique designs and innovations in all stages of IOT financial management system [33, 34]. The main manifestations are as follows.

1. Advanced. Through the IOT financial management system, most of the operations such as asset transfer, allocation and contract information signing in the past financial management of energy enterprises are dispersed to various departments of energy enterprises to complete, which makes the financial management of energy enterprises less stressful and makes the work risk of the original enterprise financial management reduced.

2. Structured. the IOT financial management system is based on the current financial management system of energy enterprises and the prevalent unit

https://doi.org/10.17993/3cemp.2023.120252.144-159

establishment status, based on a tree structure for an intuitive representation of financial management, eliminating the authority of the internal level of energy enterprises and maximizing the time saving of energy enterprise finance operations.

3. Comprehensiveness. the IOT financial management system can handle different types of management affairs in parallel by incorporating the financial management risks in the context of carbon peak into the financial management system for unified management, which not only facilitates the operation of enterprise personnel but also can reflect the financial management status of energy enterprises comprehensively.

2.1. THE FUNCTIONAL DIVISION OF THE IOT FINANCIAL MANAGEMENT SYSTEM

IOT financial management systems can be divided into client, server and mobile through C/S architecture. The client side of the IOT financial management system is mainly divided into four functional modules: financial management of energy enterprises, financial risk assessment of energy enterprises, financial statistics and reports of energy enterprises, and basic financial data of energy enterprises. The IOT financial management system is divided into two functional modules, namely, downloading financial information of energy enterprises and returning financial information of energy enterprises.

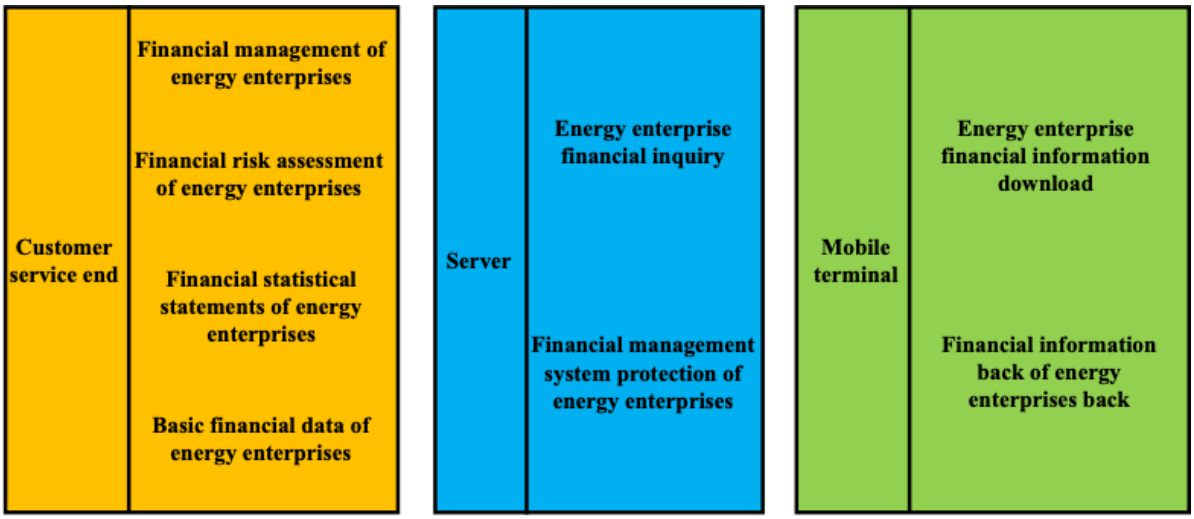

Figure 1. The functional division of IOT financial management system

2.2. MAIN MODULE FUNCTIONAL DESCRIPTION

IOT's financial management system will manage the finance of energy enterprises comprehensively, including: financial information registration, financial information inventory, financial contract changes, financial depreciation and financial information reports, a total of five major functions.

https://doi.org/10.17993/3cemp.2023.120252.144-159

1. Financial information registration. Users register the financial information of energy enterprises and institutions through mobile smart devices and transmit the data back to the database of the IOT financial management system through Web Service, and then improve the user details through financial information registration, which provides convenience for the management of back-end technicians of energy enterprises.

2. Financial information inventory: IOT financial management system takes inventory of financial information, replacing the time-consuming and laborious manual financial information inventory and tedious financial data recording, saving the labor cost and time cost of financial data inventory.

3. Financial contract changes, IOT financial management system facilitates the processing of changes to the important information of financial contracts and is used to record the changes of information after the review of energy company leaders.

4. Financial depreciation, IOT financial management system for automatic depreciation of financial data, the user only needs to regularly upload the data, eliminating the work of manual calculation and reduce the calculation of human error in the process of calculation, not only to reduce the data depreciation processing time but also to improve the accuracy of depreciation calculation rate.

5. Financial information report: IOT financial management system organizes the collected financial information and provides report service for energy enterprise management certificate so that managers can understand the information about fixed assets at all times.

2.3. USER CHARACTERISTICS AND SYSTEM APPLICATION SCENARIOS

The basic features of the IOT financial management system established in this paper are that it requires a simple operation to achieve its expected results, has a simple user interface, and practical office functions. The main objective of the IOT financial management system is to reduce the financial management pressure of energy companies and reduce the financial management risks of the companies.

Based on the background of Carbon Dafeng, we conclude that the IOT financial management system needs to achieve two major functions: identity identification and information query. The former, through the electronic tags attached to the various types of finances of energy enterprises, realize the scientific classification of the finances of energy enterprises, as well as the detailed financial information records and the identification of energy enterprise employees. It is convenient for the relevant personnel of energy enterprises to assess the enterprise's financial management risks and put forward prevention and control strategies.

https://doi.org/10.17993/3cemp.2023.120252.144-159

3. INDICATOR WEIGHTING

This paper uses an analytic hierarchy process to calculate the weight of each index in the evaluation system [35, 36]. By sending questionnaires to 100 experts in the field of financial management risks and prevention and control strategies, the importance of the selected factors was compared. See Table 1 for the scores of financial management evaluation indicators of energy enterprises.

Table 1. Scoring of financial management evaluation indicators of energy enterprises

Financial evaluation indicators	Capital concentration capacity	Business Service Capability	Profitability	Risk Management Capability
Capital concentration capacity	2	3	4	2
Business Service Capability	1	4	1	5
Profitability	4/5	2	3	1
Risk Management Capability	1	3	4	2

In summary, the judgment matrix of the financial evaluation indicators and the first-tier indicators of capital concentration capacity, operating service capacity, profitability, and risk management capacity are as follows.

$$A_1 = \begin{bmatrix} 2 & 3 & 4 & 2 \\ 1 & 4 & 1 & 5 \\ \frac{4}{5} & 2 & 3 & 1 \\ 1 & 3 & 4 & 2 \end{bmatrix} \quad (1)$$

Among them, A1 is the financial evaluation index. This paper calculates the product of each row element of judgment matrix A1 based on hierarchical analysis and calculates its n root , and the calculation process is as follows.

$$Ai = \prod a_{ij} \quad (2)$$

$$\bar{A}_i = \sqrt[n]{A_i} \quad (3)$$

Where a_{ij} is the element of the i row and j column of the judgment matrix A_1. We obtain the corresponding weight coefficients by summing up the square roots of the above equation.

4. ANALYSIS AND DISCUSSION

Among the economic control tools that drive the energy revolution, energy companies of all types prefer to have active and motivated employees and policy regulation within their own companies. Despite the absolute number of information

https://doi.org/10.17993/3cemp.2023.120252.144-159

and advice and control tools, there are still relatively limited and few ways to build a unified information and control system that allows energy companies to assess the risks of corporate financial management and propose prevention and control strategies for their personnel. It is still in the stage of development, but all of the employee engagement-type policy tools are distributed in this area. On the road to promoting low-carbon energy transition, the country hopes that energy-based enterprises will also take the initiative to participate and jointly promote the goal of carbon peak and carbon neutral strategy. Since the green and low-carbon transition of industries is mainly done by organizations such as enterprises, it is more direct and efficient to use more rigid policy tools such as regulation. In addition, energy enterprises hope that by providing a good business environment, political environment, legal environment, etc., the employees of enterprises and also the development team will vigorously carry out scientific and technological research and innovation in the field of energy-saving technology, carbon sink technology, etc., to promote the better implementation of the Carbon Dafeng carbon neutral policy.

Therefore, this paper establishes an IOT financial management system to reduce the financial management pressure of energy enterprises as well as to reduce the financial risks of enterprises. At the same time, it can also facilitate the personnel of energy enterprises to assess the enterprise's financial management risks and propose prevention and control strategies. In the analysis of this section, we conducted pilot experiments for several representative energy enterprises in Guangdong Province, China. We replace the financial management system of the target pilot energy enterprises with the IOT financial management system proposed in this paper and count the current status of financial risk management of each enterprise in the period of 2016-2020. The detailed aspects of the statistics are collected and assessed at four levels: financing, investment, operation and revenue distribution. We not only use a combination of statement analysis and indicator analysis but also will use a combination of horizontal and vertical comparisons.

4.1. IOT-BASED RISK ASSESSMENT IMPACT

Specifically, we put the built IOT financial management system to test at the pilot company in 2018, and collected and comprehensively evaluated data at four levels: funding, investment, operation and revenue distribution of the company. The results are shown in Figure 2. It is worth noting that in order to analyze the financial management of energy companies in the context of carbon peaking, several new energy companies are analyzed in this paper. Among them are representative new energy technology companies such as electrochemical energy storage, solar energy utilization and air energy storage. In terms of financing risk, the scale of liabilities of selected energy companies gradually expands in 2016-2020, with both current and non-current liabilities increasing in amount. However, in terms of the percentage of total liabilities, it is clear that energy companies are still dominated by current liabilities. In both 2016 and 2017, the proportion of current liabilities of enterprises reached more than 95%, which makes the financing means of enterprises relatively

https://doi.org/10.17993/3cemp.2023.120252.144-159

single. and leads to a higher risk of financing. And after the introduction of the IOT-based financial management system in 2018, a significant increase in the share of non-current liabilities was observed. Relative to the data from 2017, the share of current liabilities decreases by 2.96%, 7.98% and 14.59% in 2018, 2019 as well as 2020, respectively. As new energy technology is currently in a market with large economic and product fluctuations, the reduction in current liabilities is more beneficial to the long-term development of new energy technology companies in the current economic and policy context of China new energy companies. And the fixed liabilities that can be transformed into state funds are more conducive to the stability of new energy company financing. In conclusion, the IOT-based financial management system makes the financing structure of new energy companies more reasonable.

In terms of investment, it was observed that the corporate investment-to-revenue ratio was around 80% in both 2016 and 2017. And after the introduction of the IOT-based financial management system in 2018, the corporate investment-to-revenue ratio steadily increased year by year. Relative to the data in 2017, the investment-to-revenue ratio decreases by 8.74%, 22.91%, and 16.83% in 2018, 2019, and 2020, respectively. While 2020 saw a decline in the company's revenue-to-investment ratio due to the epidemic, the IOT-based financial management system still enabled revenue improvement to be maintained at a high level. This is also due to the volatility of traditional energy sources at the moment and the world's focus on new energy technologies in the context of carbon peaking.

In terms of operations, it was observed that the percentage of corporate current assets was as high as 88.5% in 2016, while it increased to 92.27% in 2017. In contrast, after the introduction of the IOT-based financial management system in 2018, the percentage of corporate current assets decreases and stabilizes year by year. Relative to the data from 2017, the investment-to-revenue ratio decreases by 6.22%, 5.48% and 6.82% for 2018, 2019 and 2020, respectively. In terms of earnings distribution, after the introduction of the IOT-based financial management system in 2018, the company's undistributed profit ratio decreases year by year. Compared to the data from 2017, the percentage of undistributed profit decreases by 9.69%, 18.82% and 35.39% in 2018, 2019 and 2020, respectively. This indicates that the IOT-based financial management system has led to a more rational structure of anti-disturbance and earnings distribution in the operation of the company, and the risk is significantly reduced.

https://doi.org/10.17993/3cemp.2023.120252.144-159

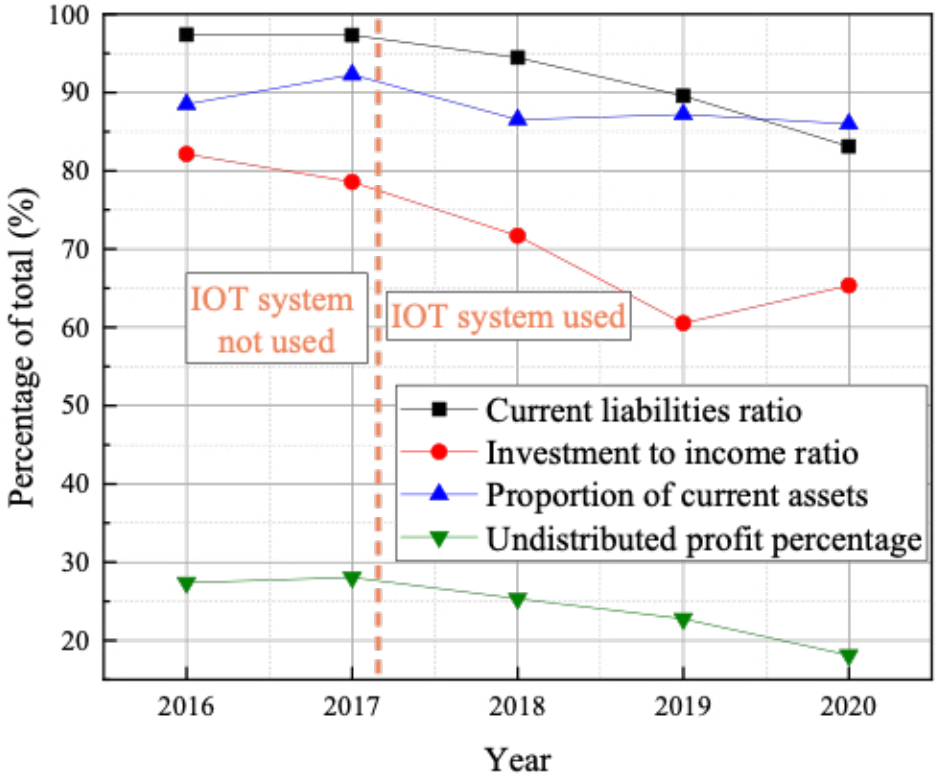

Figure 2. Impact of IOT financial management system on various financial indicators of the enterprise

4.2. THE OVERALL IMPACT OF IOT-BASED BUSINESS DEVELOPMENT

After collecting and comprehensively evaluating data at four levels of funding, investment, operations, and revenue distribution for pilot companies within the energy industry from 2016-2020, we then evaluated the entire enterprise based on its exhibition to determine the impact of the IOT-based financial management system on the overall financial management of the enterprise. We collected the mean values of financial management, integrated personnel management, and overall profit over the years 2016-2020 for several pilot enterprises in Guangdong Province, and the results are shown in Figure 3. It is observed that in terms of financial management and integrated personnel management, the capital spent on both in 2016 and 2017 remains high under the old management system, which results in the enterprises spending a lot of money on the management of financial and personnel aspects that are not related to the energy industry. At the same time, the average profit of the company was not high during the two years. Therefore, this poses a great challenge and difficulty for the development of the company. In contrast, after the introduction of the IOT-based financial management system in 2018, a very significant reduction in the funds consumed for financial management and integrated personnel management was observed. Compared to the data from 2017, the financial management costs in

https://doi.org/10.17993/3cemp.2023.120252.144-159

2018, 2019 and 2020 are 2.822, 4.358 and 5.501 times lower, respectively. And the money consumed for integrated personnel management is 2.964 times, 3.012 times and 4.004 times lower, respectively. This shows that the introduction, use and development of the IOT-based financial management system has made the overall management of funds more efficient and scientific, and the costs have been significantly reduced.

Finally, in terms of overall profit averages, it is observed that the average net profit of new energy technology companies has been steadily increasing year by year. This indicates that the introduction, use and development of the IOT-based financial management system has not affected the profit development of the companies, but the cost of management has been significantly reduced. This is more conducive to the current younger new energy technology companies to have more capital and time to develop their own energy conversion and utilization technologies and make longer-term investments for a low-carbon future.

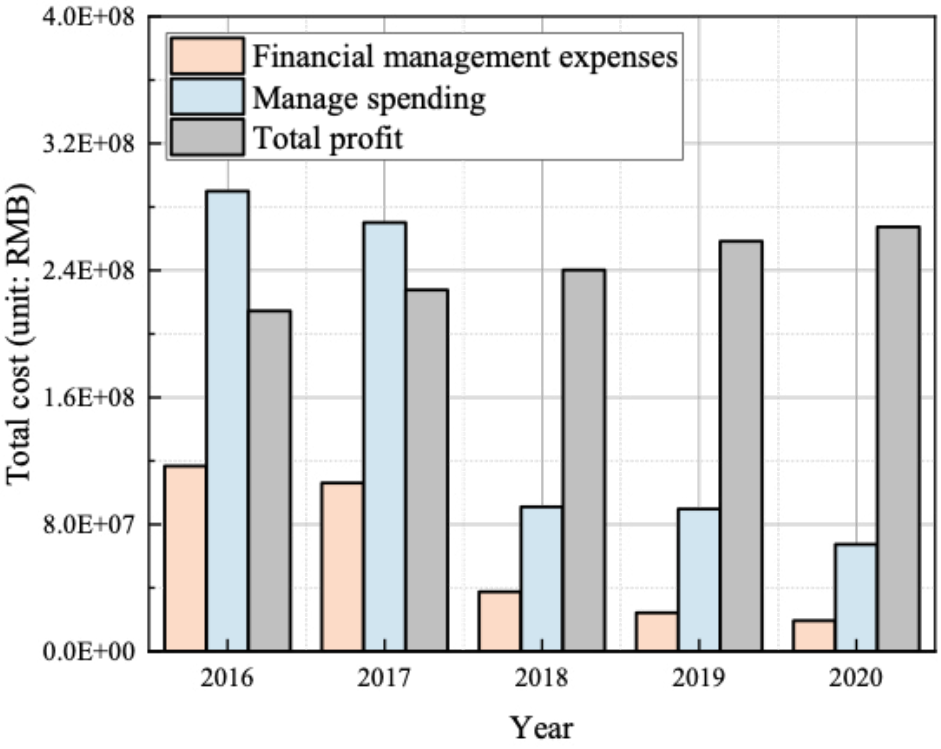

Figure 3. IOT financial management system on the overall capital impact of the enterprise

5. CONCLUSION

Despite the absolute number of developments and products of enterprise management systems and platforms, there are still relatively limited and few ways to build a unified information and control system that can enable energy enterprise stakeholders to assess enterprise financial management risks and propose prevention

https://doi.org/10.17993/3cemp.2023.120252.144-159

and control strategies. In this paper, we establish an IOT financial management system to reduce the financial management pressure of energy enterprises and reduce the financial risks of enterprises. At the same time, it can also facilitate the personnel of energy companies to assess the financial management risks and propose prevention and control strategies. We conducted a pilot experiment for several representative energy enterprises in Guangdong Province, China. We replace the financial management system of the target pilot energy enterprises with the IOT financial management system proposed in this paper and count the current status of financial risk management of each enterprise in the period of 2016-2020. The conclusions are as follows.

1. After the introduction of the IOT-based financial management system in 2018, a significant increase in the percentage of non-current liabilities was observed. Relative to the 2017 data, the percentage of current liabilities decreased by 2.96%, 7.98%, and 14.59% for 2018, 2019, and 2020, respectively. The corporate investment-to-earnings ratio decreased by 8.74%, 22.91% as well as 16.83%, respectively.

2. It is observed that the corporate current assets ratio was as high as 88.5% in 2016, while it increased to 92.27% in 2017. In contrast, after the introduction of the IOT-based financial management system in 2018, the investment-to-revenue ratio decreases by 6.22%, 5.48%, and 6.82% in 2018, 2019, and 2020, respectively. The ratio of undistributed earnings is reduced by 9.69%, 18.82%, and 35.39%, respectively. This indicates that the IOT-based financial management system has led to a more rational structure of anti-disturbance and revenue distribution in operations, and the risk is significantly reduced.

3. After the introduction of the IOT-based financial management system in 2018, a very significant reduction in the funds consumed for financial management and integrated personnel management was observed. Compared to the data from 2017, the financial management expenses are reduced by 2.822 times, 4.358 times and 5.501 times in 2018, 2019 and 2020, respectively. And the money consumed for integrated personnel management is 2.964 times, 3.012 times and 4.004 times lower, respectively. This shows that the introduction, use, and development of the IOT-based financial management system has made the overall management of funds more efficient and scientific, and the costs have been significantly reduced.

REFERENCES

(1) Savary, S., & Willocquet, L. (2020). Climate change and global food security. Annual Review of Phytopathology, 58(1).

(2) Lamnatou, C., & Chemisana, D. (2022). Solar thermal systems for sustainable buildings and climate change mitigation: Recycling, storage, and avoided environmental impacts based on different electricity mixes. Solar Energy, 231, 209-227.

https://doi.org/10.17993/3cemp.2023.120252.144-159

(3) Yang, P., et al. (2022). Analysis of drought and flood alternation and its driving factors in the Yangtze River Basin under climate change. Atmospheric Research, 270, 106087.

(4) Kaky, E. D., et al. (2022). Predicting current and future habitat refuges for conservation of wild goat (Capra aegagrus Erxleben 1777) under climate change in Iraq. Journal of Arid Environments, 199, 104699.

(5) Mohanty, M. P., & Simonovic, S. P. (2021). Changes in floodplain regimes over Canada due to climate change impacts: Observations from CMIP6 models. Science of The Total Environment, 792(1–4), 148323.

(6) Bambach, N. E., et al. (2021). Projecting climate change in South America using variable-resolution Community Earth System Model: An application to Chile. International Journal of Climatology.

(7) Maruffi, L., et al. (2022). Soil erosion and sediment transport under climate change for Mera River, in Italian Alps of Valchiavenna. Science of The Total Environment, 806, 150651.

(8) Dinga, C. D., & Wen, Z. (2022). China's green deal: Can China's cement industry achieve carbon neutral emissions by 2060? Renewable and Sustainable Energy Reviews, 155, 111931.

(9) Weng, Y., Cai, W., & Wang, C. (2021). Evaluating the use of BECCS and afforestation under China's carbon-neutral target for 2060. Applied Energy, 299, 117263.

(10) Wang, F., Wu, M., & Hong, J. (2020). Exploring the Effects of Industrial Structure, Technology, and Energy Efficiency on China's Carbon Intensity and Their Contributions to Carbon Intensity Target. Sustainability, 12.

(11) Wang, F., et al. (2021). Has the Economic Structure Optimization in China's Supply-Side Structural Reform Improved the Inclusive Green Total Factor Productivity? Sustainability, 13.

(12) Chen, M. (2022). A study of low-carbon development, urban innovation, and industrial structure upgrading in China. International Journal of Low-Carbon Technologies.

(13) Cao, L., & Wang, H. (2022). The Slowdown in China's Energy Consumption Growth in the "New Normal" Stage: From Both National and Regional Perspectives. Sustainability, 14.

(14) Yang, H., et al. (2021). Using system dynamics to analyze key factors influencing China's energy-related CO2 emissions and emission reduction scenarios. Journal of Cleaner Production, 320, 128811.

(15) Yi-Chung, H. (2017). Nonadditive grey prediction using functional-link net for energy demand forecasting. Sustainability, 9(7), 1166.

(16) Shahbaz, M., Chaudhary, A. R., & Ozturk, I. (2017). Does urbanization cause increasing energy demand in Pakistan? Empirical evidence from STIRPAT model. Energy, 122(MAR.1), 83-93.

(17) Yi-Chung, Jiang, & Peng. (2017). Forecasting energy demand using neural-network-based grey residual modification models. The Journal of the Operational Research Society.

https://doi.org/10.17993/3cemp.2023.120252.144-159

(18) Subbiah, Rajesh, Pal, Anamitra, Nordberg, & Eric, K., et al. (2017). Energy demand model for residential sector: a first principles approach. IEEE Transactions on Sustainable Energy.

(19) Bayomi, N., & Fernandez, J. E. (2017). Trends of energy demand in the Middle East: a sectoral level analysis. International Journal of Energy Research.

(20) Chaturvedi, S., & Rajasekar, E. (2022). Application of a probabilistic LHS–PAWN approach to assess building cooling energy demand uncertainties. Building Simulation, 15(3), 373-387.

(21) Gallic, T. L., & Assoumou, E. (2017). Future demand for energy services through a quantitative approach of lifestyles. Energy, 141(PT.2), 2613-2627.

(22) Shemer, H., & Semiat, R. (2017). Sustainable RO desalination–energy demand and environmental impact. Desalination, 424, 10-16..

(23) Qiu, S., et al. (2021). Energy Demand and Supply Planning of China through 2060. Energy, 234(11), 121193.

(24) Lu, S., et al. (2022). Network herding of energy funds in the post-Carbon-Peak Policy era: Does it benefit profitability and stability? Energy Economics, 109, 105948.

(25) Li, T., et al. (2022). Environmental Performance Evaluation of New Type Thermal Power Enterprises Considering Carbon Peak and Neutrality. Sustainability, 14.

(26) Cui, X., et al. (2021). An Improved Forecasting Method and Application of China's Energy Consumption under the Carbon Peak Target. Sustainability, 13.

(27) Lin, J., et al. (2022). From peak shedding to low-carbon transitions: Customer psychological factors in demand response [Research report].

(28) Chen, J. (2017). An Empirical Study on China’s Energy Supply-and-Demand Model Considering Carbon Emission Peak Constraints in 2030. Engineering, 3(4), 512-517.

(29) Hao Lin. (2021). Differential equation model of financial market stability based on big data. Applied Mathematics and Nonlinear Sciences. doi:10.2478/AMNS.2021.2.00146.

(30) Mirzaei, M.A., et al. (2021). Robust Network-Constrained Energy Management of a Multiple Energy Distribution Company in the presence of Multi-Energy Conversion and Storage Technologies. Sustainable Cities and Society, 103147.

(31) Wang, L., & Wang, Y. (2021). Supply chain financial service management system based on block chain IoT data sharing and edge computing. AEJ - Alexandria Engineering Journal, 13.

(32) Zhang, X., & Wang, Y. (2021). Research on Prepaid Account Financing Model Based on Embedded System and Internet of Things. Microprocessors and Microsystems, 82(4), 103935.

(33) Dong, J., et al. (2021). A framework of pavement management system based on IoT and big data. Advanced Engineering Informatics, 47(2), 101226.

(34) Zhu, L., Li, M., & Metawa, N. (2021). Financial Risk Evaluation Z-Score Model for Intelligent IoT-based Enterprises. Information Processing & Management, 58(6), 102692.

https://doi.org/10.17993/3cemp.2023.120252.144-159

(35) Che, L., et al. (2020). A New Method for Deriving Weights in Group Fuzzy Analytic Hierarchy Process and Evaluation Measures. IFAC-PapersOnLine, 53(2), 7941-7946.

(36) Chen, S., et al. (2020). Multi-objective economic emission dispatch of thermal power plants based on grey relational analysis and analytic hierarchy process. Energy & Environment, 31.

https://doi.org/10.17993/3cemp.2023.120252.144-159