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Construction of Financial Sharing Service System for New Energy Enterprises Based on Particle Swarm Optimization Algorithm

Yueran Xu[1]*

[1] *Department of Financial Management,*
Gingko College of Hospitality Management, Chengdu 61174, Sichuan, CHINA

*Corresponding Author: yueran.xu@gingkoc.edu.cn
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Abstract

Financial Shared Service (FSS) is key to achieving enterprise strategic objectives, resolving financial problems, and transforming financial management methods. In light of the increasingly serious financial crisis, new energy enterprises must adopt the latest information technology to change the FSS model. This can effectively address several issues, including low efficiency, poor quality, and high costs, in enterprise FSS. The FSS system is a large business system with a flexible structure and a vast scale, requiring careful design. Its progressiveness, reliability, and availability also need meticulous planning. This paper proposes the use of Quantum Particle Swarm Optimization (QPSO), based on an in-depth study of Particle Swarm Optimization (PSO). This approach can prevent particles from falling into local optimization traps and enhance the accuracy of the PSO algorithm. By improving the inertia weight, we increased the information exchange between individuals and enhanced population diversity. The experimental results in this paper demonstrate that when the number of tasks was 50, the time taken by PSO and QPSO for 50 iterations was 0.6 seconds and 0.7 seconds, respectively. For 400 iterations, it took 25.0 seconds and 13.8 seconds. When the number of tasks increased to 100, PSO and QPSO required 1.8 seconds and 1.6 seconds, respectively, for 50 iterations, and 47.5 seconds and 20.1 seconds, respectively, for 400 iterations. This indicates that QPSO is producing results more quickly.

1. Introduction

As global economic integration advances, an increasing number of new energy enterprises are expanding production, increasing their business scale, and broadening their reach to compete for larger market shares and more resources, thereby creating a group of transnational, large-scale enterprises. However, the intensifying competition and growing scale have introduced numerous challenges for the growth of these new energy companies. To cut costs, enhance control, mitigate risks, and increase value, businesses should implement reforms and innovations tailored to their circumstances, maintain competitive advantages, and strive for sustainable development.

With the ongoing advancement of information technology, there are rising expectations for the Financial Sharing Services (FSS) of new energy companies. It must not only ensure the timeliness, accuracy, and sharing of financial data but also bolster the collection and analysis of information to provide a reliable foundation for business decision-making. To maximize overall scale and synergy, further reduce costs, improve efficiency, and enhance control, many companies are concentrating resources on sharing core business functions, restructuring various non-core operations, and ensuring the optimal utilization of FSS.

2. Related Work

With the development of new energy enterprises, the FSS model is becoming increasingly important. Yu, Kejia [1] found that rapid economic and technological progress has compelled innovations in financial strategy and organizational structure to better meet the endogenous needs of expanding companies. His research focused on the financial sharing model, which has attracted significant attention in recent years. It examined changes in working capital management performance during different stages of financial sharing development. The study found that implementing the financial sharing model had a positive impact on the company's performance.

Wang, Chaohua [2] proposed that modern financial management should establish a financial sharing center. The emergence of financial sharing services has transformed the financial services landscape. The shared service center was divided into four categories: computer system shared service center, human resources shared service center, procurement shared service center, and supply chain shared service center.

Zhou, Xiuying [3] believed that FSS aimed to enhance efficiency in enterprises by addressing a series of issues, including high financial costs, low financial management efficiency, and structural redundancy. He developed a financial sharing information security evaluation system to assess the capability of financial sharing in protecting information security. The results indicate that financial sharing management based on cloud computing can effectively reduce financial costs and enhance the efficiency of enterprise financial management. The aforementioned scholars agreed that the financial sharing model has significantly improved the quality of financial information and process efficiency.

In line with the trend of modern enterprise intelligence development, the FSS model can be established and promoted, thereby initiating the transformation of financial sharing forms and creating a new financial management model. Luo, Yanni [4] proposed that FSS, as one of the most prevalent forms of enterprise management in the intelligence era, was initially dispersed across various fields and the accounting functions of individual entities. On the one hand, it can maintain account and statement consistency; on the other hand, it can effectively reduce system costs. Therefore, FSS is a vital management tool for enterprises to enhance efficiency and lower capital costs.

Chen, Qianqian [5] suggested that, in the context of the internet, alongside the continuous advancement of information technologies such as big data, the Internet of Things, and cloud computing, financial sharing has undergone rapid evolution. Financial sharing is becoming increasingly important in enterprise management accounting. He explored and analyzed the feasibility of building a management accounting system under the financial sharing model.

Xueyan Ding [6] found that with the advent of the significant data intelligence era, the construction process of enterprise financial intelligence has accelerated. The operation and management model of the enterprise financial center is shifting from the traditional approach to intelligent and automated management. He elaborated on the theory of financial sharing and its operational management, along with big data intelligence, which can provide essential theoretical support for future optimization. FSS can offer valuable insights for the application of enterprise financial management, optimizing operations, and enhancing enterprise performance.

The FSS system utilizes sharing technology to exchange information in real-time, provide financial knowledge support, and minimize the scattered deployment of financial professionals. Additionally, the FSS system can gather and store actual combat experience and expertise in real time to develop valuable resources. This capability offers a quick and efficient solution for similar challenges in the future [7-8]. Under the traditional decentralized financial management model, achieving centralized allocation and utilization of global fund accounts is not feasible. However, the construction of the FSS model can address the needs of enterprises' international strategic development and financial refinement management. Consequently, research on the FSS system, utilizing the latest innovations in information technology, such as cloud computing and big data, holds crucial practical significance for advancing the globalization strategy of new energy enterprises and optimizing financial management.

3. PSO and QPSO Methods

The study will employ a mixed research approach that incorporates simulation-based optimization and feedback obtained through data-driven input from enterprises. Initially, a computational simulation is conducted using the CloudSim platform to evaluate the effectiveness of the proposed Quantum Particle Swarm Optimization (QPSO) algorithm in optimizing task scheduling within a Financial Shared Service (FSS) system. The simulation involves comparing QPSO and traditional PSO in controlled experimental conditions to assess their performance in terms of execution time, convergence efficiency, and resource utilization. At the same time, an enterprise survey is conducted among companies in the new energy sector to gain a deeper understanding of the problems and expectations regarding financial sharing services. The separate simulation and field data are combined into a more detailed analysis of both the technical performance and the practical usefulness. Figure 1 illustrates the methodology conducted in this study.

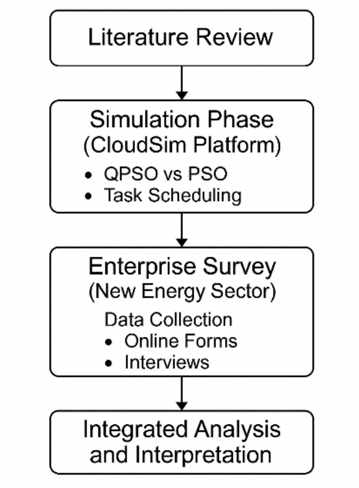

Fig. 1 *Types of financial sharing*

A formal survey of 12 new energy enterprises was conducted to provide a more accurate picture of the simulation findings. Purposive sampling was employed in the study, where the sample consisted of financial managers, IT officers, and operational personnel involved in implementing shared services. One month was used to gather information through online questionnaires and subsequent interviews. Some of the major fields covered by the survey included the complexity of tasks performed in financial processes, the current rate of resource allocation, system bottlenecks, and the anticipation of automation in scheduling solutions. Analysis of the responses revealed a trend analysis and the justification of the relevance of the opted QPSO-based optimization model to the actual operational needs.

3.1 Advantages of Establishing an FSS System for New Energy Enterprises

Although implementing FSS can bring many benefits to the financial performance of new energy enterprises, in China, these enterprises have not been established for long and lack substantial successful experience. Therefore, most enterprises are currently implementing or preparing to implement this FSS model, and its success remains uncertain [9-10]. New energy enterprises that are currently implementing or plan to implement FSS can make adequate plans based on their economic environment and industry status to minimize unnecessary mistakes. The system established in this paper holds significant reference value. The types of financial sharing are shown in Figure 2:

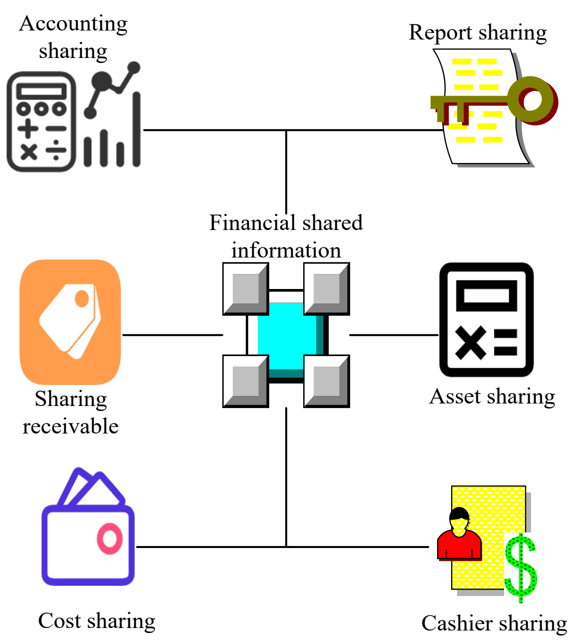

Fig. 2 *Types of financial sharing*

As shown in Figure 1, financial sharing encompasses expense sharing, report sharing, accounting sharing, cashier sharing, and asset sharing [11]. The patterns of operational inefficiencies in the FSS system focus on utilizing PSO to optimize task allocation, resource allocation, and work balancing. The algorithm can be integrated into the main modules of the FSS system, enabling dynamic scheduling and informed decision-making. With its ability to constantly respond to altering task pressures and resource levels, QPSO increases work rate and the overall performance of all systems, which is why it becomes an appropriate choice when addressing the intricate needs of enterprises in new energy. Currently, benchmarking enterprises in the new energy sector have implemented the FSS system, setting a strong precedent for the development of the new energy industry. Generally, the FSS system is driven by enhanced financial control, increased financial efficiency, and the integration of industry and finance [12]. The advantages of establishing an FSS system for new energy enterprises include:

(1) Reducing costs and improving efficiency: The investment scale of new energy enterprises is substantial, and their geographical distribution is extensive. An FSS system can centralize economic affairs that are dispersed across China and around the globe. Financial sharing streamlines business processes by eliminating non-value-adding operations as well as redundant and repetitive intermediate processes. Through assembly line operations, financial employees quickly develop expertise, and the improvement in business processing efficiency directly leads to reduced human and administrative costs [13].

(2) Integrating financial resources fosters financial transformation: New energy enterprises have achieved rapid transfer of financial information by establishing the data integration function of the FSS system. Concurrently, many senior financial personnel have moved away from daily onerous tasks, allowing them to focus on implementing the enterprise’s financial strategy and management accounting, thereby enhancing the enterprise's value creation: To establish and enforce the FSS system, it is vital to clarify the necessity and feasibility for the enterprise to create and operate the shared service system and to gain recognition and support from enterprise management [14]. Based on the information platform, the sharing of service-related systems can facilitate the reorganization of enterprise financial and business processes, achieving standardization. It can efficiently allocate human resources and establish an effective financial management system.

3.2 Construction of FSS System

According to the principle of work standardization, similar and non-core businesses can be consolidated into one unit, allowing for simplified work processes. Additionally, the “business that cannot be integrated” can be re-integrated, with a focus on maximizing division of labor and cooperation while ensuring clear responsibilities. Fuelled by the dual functions of sharing and service, the innovation mechanism for sharing and service can be enhanced through improvements in the institutional norms and business processes of the FSS system to meet the demands of enterprise financial management.

(1) Main function analysis of the FSS system: The FSS system is specifically designed to meet the needs of FSS. It provides financial personnel with functionalities such as statement generation, payment voucher processing, image matching, expense reporting review, image retrieval, and image management [15]. It is essential to support the staff of the FSS Center in managing business processes and to enable fast and accurate sharing of financial information. The specific functional structure of the FSS system is shown in Figure 3. As shown in Figure 3, the core subsystem of the entire FSS system consists of the expense reporting management subsystem and the image management subsystem. The expense reporting management subsystem primarily provides functions related to entering expense reporting information, approving expense reporting lists, reviewing expense reports, and providing message services. Information entry is mainly used to input the reimbursement amount, reimbursement company, and other related documents into the system [16]. The approval of the expense report list involves establishing an approval process based on account number, business category, and other relevant factors, and promptly publishing the submitted information to the automated office platform and other auxiliary systems through to-do items to facilitate online approval [17]. The image management subsystem includes functions for remote document image collection, image transmission, image retrieval, and image matching. Remote document image collection entails printing a barcode and scanning it. During the scanning process, the corresponding data can be quickly obtained according to the barcode to generate the relevant descriptive information of the image file [18].

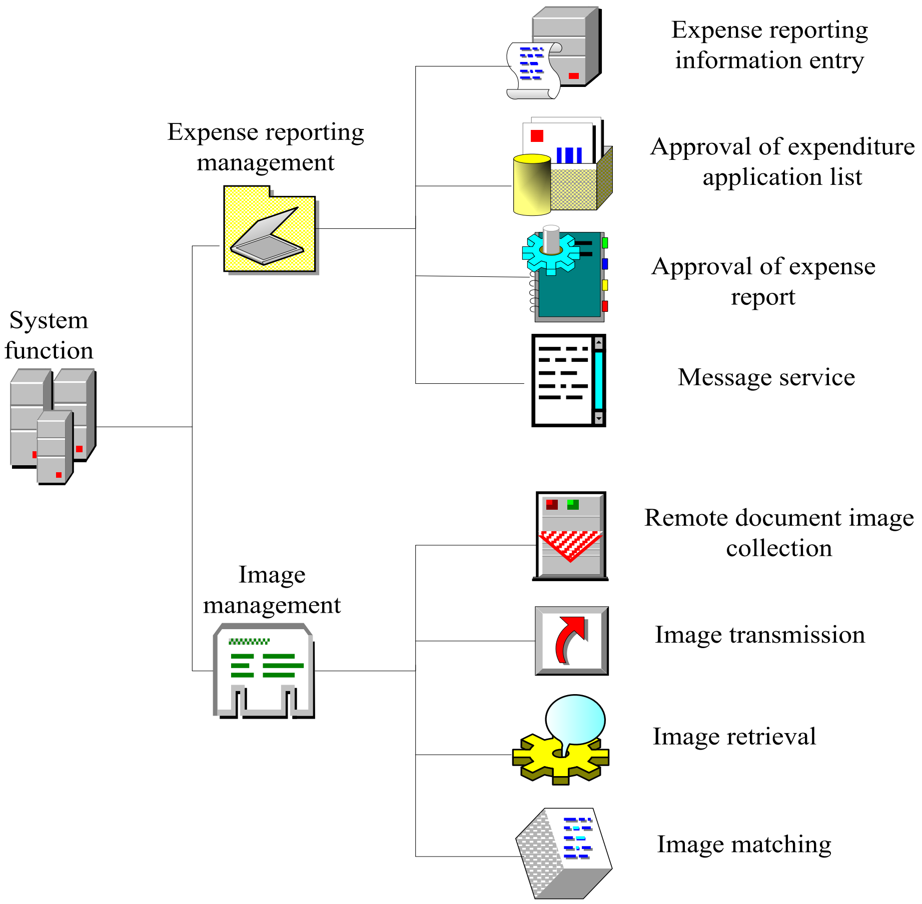

Fig. 3 *Specific functional structure of the FSS system*

(2) Office automation notification of the FSS system: It enables enterprises to utilize a complete office automation system, allowing all work to be conducted on this platform. When designing the system, developers considered the interface for providing information, publishing, and push services. To integrate with the office automation system, it is necessary to adopt a notification interface based on the automation design concept and ensure interaction with the business to achieve seamless integration between the two systems. The schematic diagram of the office automation notification is shown in Figure 4:

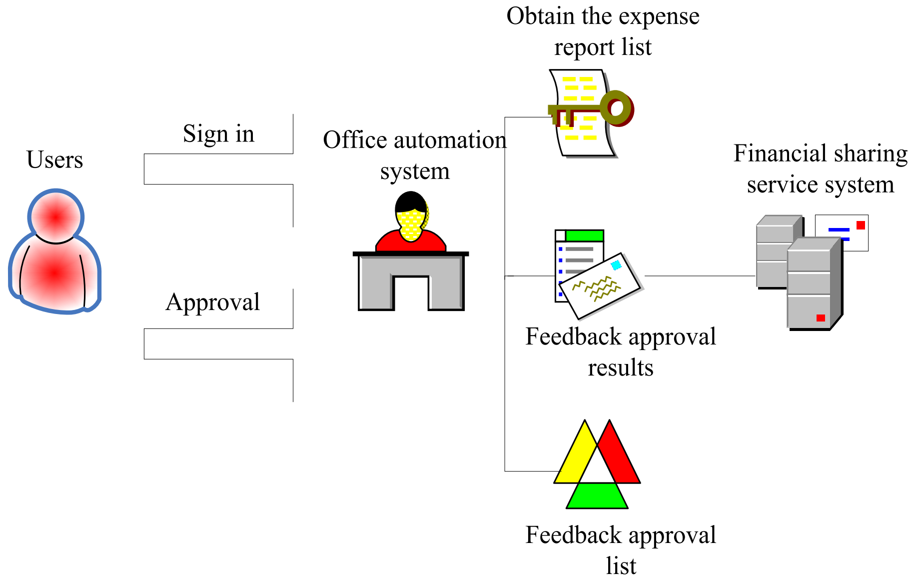

Fig. 4 *Schematic diagram of office automation notification*

As shown in Figure 4, upon notification from the office automation system, the user logs in to the office automation system for approval, obtains the reimbursement list, provides the approval results, and then submits the approval list through the FSS system. The process of office automation notification involves publishing the reimbursement list query as a standard interface [19]. After the approver logs in to the system, the system's to-do list interface calls the approval list query service and presents it to the approver for approval. After approval is completed, the system will call the FSS reimbursement list update service to update the status of the corresponding reimbursement list, thereby automatically updating the reimbursement list.

(3) FSS system business processing flow: In general, an ordinary system can meet the project's basic requirements as long as it completes the core processes and tasks. However, if a complex FSS system is to succeed, it needs to monitor every link from planning to implementation and formulate corresponding countermeasures during implementation. Therefore, selecting a suitable FSS system is particularly important [20]. The construction model of the FSS system is shown in Figure 5:

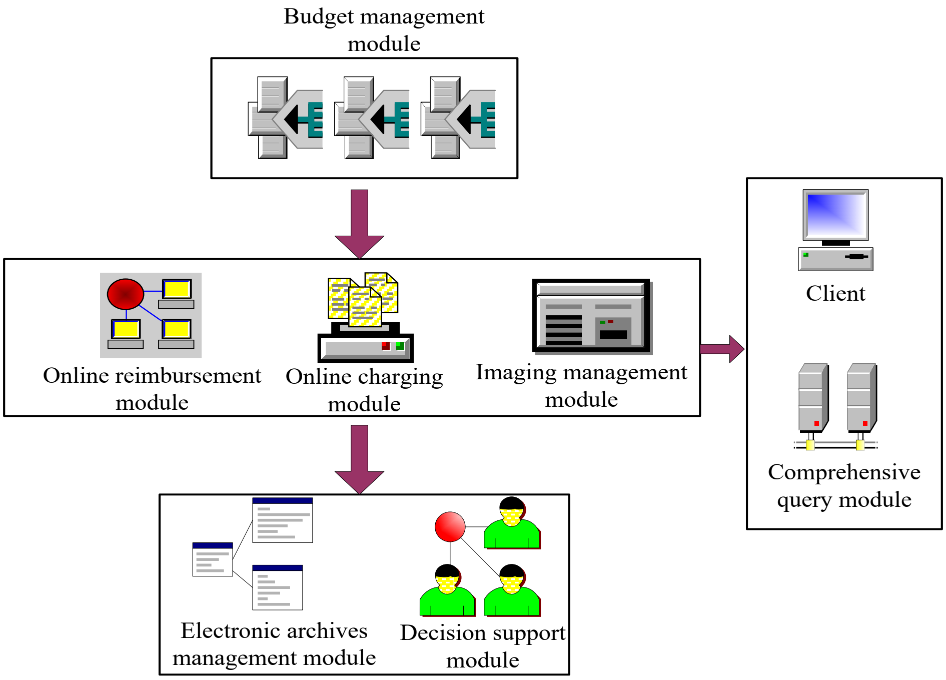

Fig. 5 *Construction model of the FSS system*

As shown in Figure 5, the current FSS system informatization is mainly divided into seven modules: budget management module, online reimbursement module, online charging module, image management module, electronic file management module, decision support module, and comprehensive query module. The FSS system provides enterprises with fund settlement, report preparation, tax basis, process optimization, data support, and training support, among other services. The FSS system must ensure the accuracy and timeliness of enterprise financial information in accordance with the provisions of accounting standards and the enterprise economic system.

(4) FSS system information construction: Advanced information technology enables FSS information channels to communicate across time and space, and the information-based FSS system reduces user waiting time. Business process operations can be processed in parallel, thereby improving the quality and efficiency of the FSS system's process operations [21]. The information-based FSS system enables knowledge innovation at all posts to accumulate at any time. Through the automatic storage of financial business data in the cloud, excellent experience, knowledge, and other data can be solidified, automatically collected, transmitted, and analysed, as shown in Figure 6:

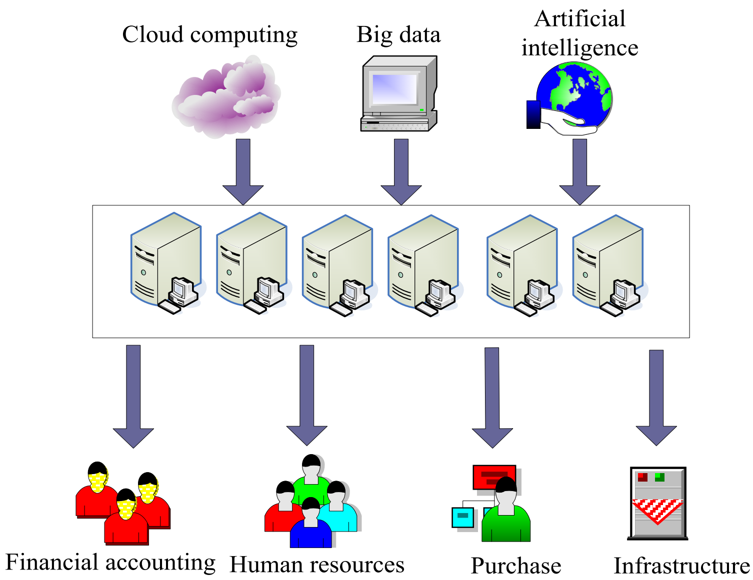

Fig. 6 *FSS system information construction*

As shown in Figure 6, the informatization of the FSS system reduces costs associated with financial accounting, human resources, procurement, and infrastructure by leveraging cloud computing, big data, artificial intelligence, and other information technologies. The enterprise implements advanced information technology to achieve a paperless office. Enterprise managers can use computers and various mobile devices to conduct business approvals at any time and from anywhere, with the system automatically completing and transmitting them in real-time. The establishment of the FSS system does not rely solely on financial personnel or sales staff, thus avoiding unnecessary manpower or transactions [22].

The FSS system is an intensive and efficient mode of financial management. It can maximize the integration of enterprise financial resources and fully utilize the advantages of enhancement, thereby improving enterprises' financial control capabilities. Establishing the FSS system enables numerous financial talents to operate freely, better understand the creation of financial value, and ultimately transform finance from a passive service into an active value creator.

3.3 PSO Method Analysis

PSO is proposed by observing where birds cooperate to find food. Birds would remember their flight path and the surrounding environment when searching for food. Therefore, particle update in PSO is realized by the external environment, the motion information of other particles, and their own flight information. The PSO method has the characteristics of fewer parameters, fast convergence, easy implementation, and expansion. The particle swarm tracks the best particle and iterates several times according to its own position and speed to obtain the best result. Set the search community size of particles to A particles:

$$A_i = \left(A_{i1}, A_{i2}, \ldots, A_{ia}\right) \tag{1}$$

Where i represents the individual extreme value searched by particle swarm, and the population is expressed in g, and the speed of PSO updates V_{id}^{k+1} formula as follows:

$$V_{id}^{k+1} = V_{id}^{k} + c_1 r_1 \left(p_{id}^{k} - a_{id}^{k}\right) + c_2 r_2 \left(p_{gd}^{k} - a_{gd}^{k}\right) \tag{2}$$

In the formula, r_1 and r_2 are two functions with random values in the interval (0,1).

The PSO method has been widely applied in various fields due to its fast calculation speed and ease of implementation. However, in iteration, its global search ability is very weak, and it may not be able to find a proper global optimal solution. Several feasible suggestions have been proposed to address the aforementioned problems. The improvement of the basic PSO is that the inertia weight ω is added in the speed iteration update, and the formula is as follows:

$$V_{id}^{k+1} = \omega V_{id}^{k} + c_1 r_1 \left(p_{id}^{k} - a_{id}^{k} \right) + c_2 r_2 \left(p_{gd}^{k} - a_{gd}^{k} \right) \tag{3}$$

The optimization performance of the system is greatly improved by increasing the inertia weight ω. The inertia weight is an important factor that affects the particle's motion. An appropriate ω also helps the PSO to achieve optimization locally and globally [23].

The improved inertia weight ensures that the algorithm has good global optimization ability at the initial value, and can quickly find the region close to the global optimum. It can achieve a better global optimization effect when it is close to global optimization. Linear decreasing inertia weight ω is:

$$\omega = \omega_{start} - \frac{\omega_{start} - \omega_{end}}{T_{\max}} \times T \tag{4}$$

3.4 QPSO Method

The motion of particles in PSO is affected by position and speed. At the same time, due to the limited speed of particles, their search range cannot encompass all feasible solutions, making it easy for them to fall into local optimization and fail to guarantee overall convergence. To overcome the shortcomings of PSO, it can be combined with the correlation characteristics of particle swarm and the fundamental theory of quantum mechanics. On this basis, the traditional PSO is improved, and QPSO is obtained.

The core idea of QPSO is that particles exhibit certain quantum mechanical behaviors; that is, the position and velocity of particles cannot be determined simultaneously, and there is no fixed orbit. They would attract around the core particles, which can ensure the overall performance of the particle swarm. QPSO first uses the wave function to describe the state of particles, and then calculates the probability density $A(t)$ of particles in a specific space:

$$A(t) = p + \frac{L}{2} In\left(\frac{1}{u}\right) \tag{5}$$

u is a random number. The Monte Carlo method, also known as the statistical simulation method or statistical test method, is a numerical simulation technique that focuses on probability phenomena as its research object. Finally, use the Monte Carlo simulation method $mbest(t)$ to determine the specific position of particles:

$$mbest(t) = \frac{1}{M} \sum_{i=1}^{M} P_{it} \tag{6}$$

M represents the population size of particles; P represents the dimension of the particle.

Based on learning and studying PSO, QPSO improved the particle size and modified some parameters of PSO, such as the inertia weight ω.

Inertia weight ω is the key parameter of global search and local search. Reasonable use can effectively improve the optimization search efficiency and shorten the calculation cycle. The inertia weight ω can be divided into linear, nonlinear, and random.

The inertia weight ω mentioned above is a classic linear strategy, but with the decrease of ω If the particle's flight speed were to slow, its search performance would be greatly improved. It is very likely that the algorithm cannot go out of local optimization [24]. This paper presents a linear differential decline strategy based on the inertia weight:

$$\frac{d\omega(t)}{dt} = \frac{2(\omega_{start} - \omega_{end})}{T_{\max}} \times T \tag{7}$$

After sorting, people can get the calculation formula of the inertia weight ω added with differential strategy:

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$$\frac{d\omega(t)}{dt} = \omega_{start} - \frac{2(\omega_{start} - \omega_{end})}{T_{\max}} \times T \tag{8}$$

When solving practical problems, the linear method of inertia weight often has significant limitations, making it easy to fall into local optimization, which restricts its application. Then the experts used a nonlinear method to correct the inertia weight, and the formula expression is:

$$\omega(t) = \frac{T}{T_{\max}}, 0 \le T_{\max} \le 1 \tag{9}$$

In the early stage of iterative search, the nonlinear method can ensure global optimization and conduct local search within a certain range. Particle fitness value refers to the distance between the current position of particles and the best solution. With the increase in the number of iterations, the particles in the population move towards the best solution, and the distance between them also decreases. Without the optimal solution, if the objective function is not continuously optimized, the particles would wander around the optimal solution and finally fall into local optimization. In this paper, particle aggregation Fa is introduced to evaluate the evolution of particle groups:

$$Fa = \frac{f(P_{gd})}{\frac{1}{M}\sum f(P_{id})} \tag{10}$$

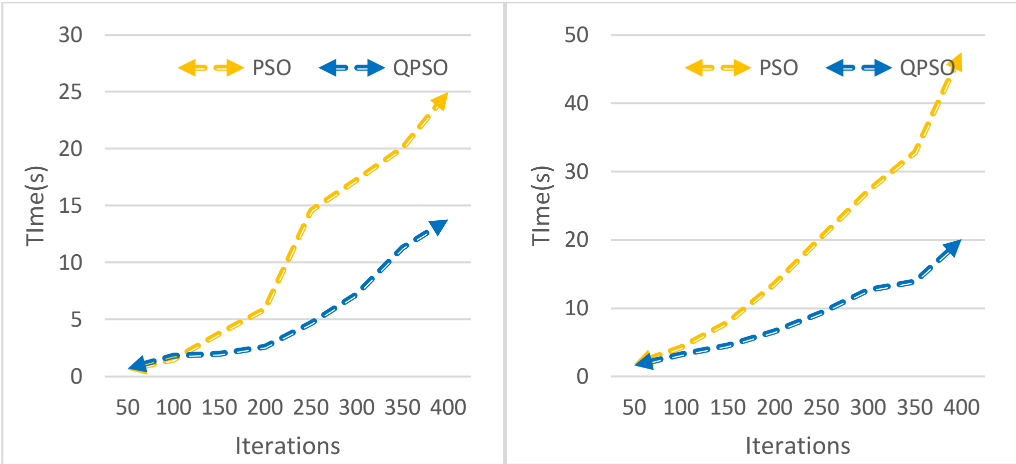
In the formula, $f(P_{gd})$ represents the fitness value of each particle's historical optimal value, and $f(P_{id})$ represents the fitness value of the current global particle's historical optimal value.

4. Comparison of Effects of Different Methods and System Application Effects

4.1 Comparison of Effects of Different Methods

The simulation that will be maintained is performed using the CloudSim platform, which simulates the working environment of a Financial Shared Service (FSS) system, including each of the so-called task entities in a financial workload, such as processing an invoice, reconciling a budget, or generating a report. These activities take the form of computational tasks that should be assigned to virtual machines (VMs) in the shared service center, which depicts real-life scenarios of resource distributions. The work of optimization aims to minimize the overall execution time while also optimizing the workload within accessible service units. This is through the dynamic scheduling of the task into correct VMs by means of the PSO technique, as well as the presented QPSO. The optimization objective function includes measurement of the time of task completion and load distribution across the system, which are the most essential performance indicators of the FSS environment.

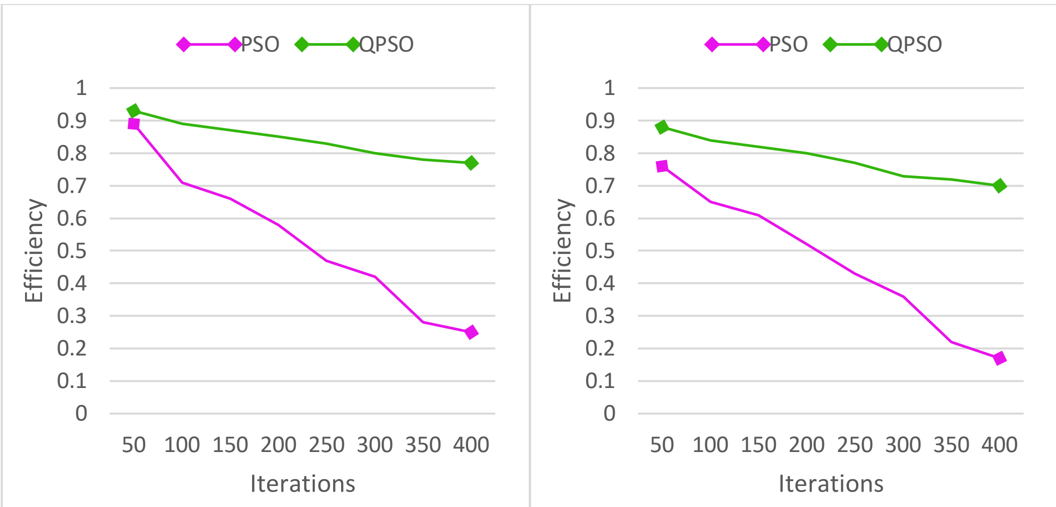
To achieve a reasonable comparison, the parameters of the PSO and QPSO algorithms should be set equally: the population size consists of 30 particles, the number of iterations is 400, and the task datasets (50 and 100 tasks) are also equal. The convergence efficiency is measured by determining how long the algorithm takes to find a stable or optimal solution, thereby demonstrating the rate at which effective scheduling strategies are discovered. Power loss is visualized in the simulation environment as idle or underutilized resources, represented as a percentage of computing resources that are not assigned to active tasks due to inefficient task allocation. These measures enable the quantification of each algorithm's ability to enhance FSS performance in various workload scenarios. The time spent by PSO and QPSO algorithms under different tasks is shown in Figure 7:



(a) Time spent when the number of tasks is 50 (b) Time spent when the number of tasks is 100

Fig. 7 *Time spent by the algorithm on different tasks*

As shown in Figure 7, according to the data in (a), when the number of tasks is 50, the time taken by PSO and QPSO with 50 iterations is 0.6 seconds and 0.7 seconds, respectively. For 150 iterations, the time taken by PSO and QPSO is 3.8 seconds and 2 seconds, respectively, while for 300 iterations, PSO and QPSO take 17.3 seconds and 7.2 seconds, respectively. Finally, for 400 iterations, the time taken by PSO and QPSO is 25.0 seconds and 13.8 seconds, respectively. According to the data analysis in (b), when the number of tasks is 100, PSO and QPSO require 1.8 seconds and 1.6 seconds, respectively, with 50 iterations. With 150 iterations, the time taken is 7.9 seconds for PSO and 4.5 seconds for QPSO. For 400 iterations, the times taken by PSO and QPSO are 47.5 seconds and 20.1 seconds, respectively. This part compares the convergence efficiency of PSO and QPSO, as shown in Figure 8:



(a) Convergence efficiency when tasks are 50 (b) Convergence efficiency when tasks are 100

Fig. 8 *Convergence efficiency of the algorithm under different tasks*

As shown in Figure 8, with 50 tasks, the convergence efficiencies of PSO and QPSO are 0.71 and 0.89, respectively, after 100 iterations. For 200 iterations, the convergence efficiencies of PSO and QPSO are 0.58 and 0.85, respectively. When the number of iterations increases to 300, the convergence efficiency of PSO and QPSO is 0.42 and 0.80, respectively. Finally, at 400 iterations, the convergence efficiencies of PSO and QPSO are 0.3 and 0.77, respectively. It is observed from (b) that when the number of tasks is 100, the convergence efficiency of PSO and QPSO is 0.65 and 0.84 at 100 iterations. For 200 iterations, the convergence efficiencies of PSO and QPSO are 0.52 and 0.80, respectively. At 300 iterations, these values are 0.36 and 0.73, respectively. When the iterations reach 300, the convergence efficiencies of PSO and QPSO are 0.2 and 0.70, respectively. PSO tends to fall into a local optimal state when searching for the objective function, preventing it from escaping and consequently hindering its ability to find a better global optimal solution. In contrast, QPSO can more effectively escape from local optimal solutions, enabling it to achieve global optimization.

In terms of power loss comparison, the results obtained using QPSO conform to the constraints designed in this work, and there is no out-of-bounds phenomenon, which improves the system's performance. The power loss of PSO and QPSO after system operation is shown in Table 1:

Table 1 *Power loss of PSO and QPSO*

Number of samples	PSO	QPSO
50	0.03%	0.01%
100	0.08%	0.03%
150	0.19%	0.07%
200	0.29%	0.12%
250	0.43%	0.18%
300	0.55%	0.26%
350	0.69%	0.31%
400	0.77%	0.35%

As shown in Table 1, when the number of iterations is 50, the loss rates of PSO and QPSO are 0.03% and 0.01%, respectively. When the number of iterations is 150, the loss rates of PSO and QPSO are 0.19% and 0.07%, respectively. When the number of iterations is 250, the loss rates of PSO and QPSO are 0.43% and 0.18%, respectively. When the number of iterations is 350, the loss rates of PSO and QPSO are 0.69% and 0.31%, respectively.

4.2 Application Effect of Service System

FSS has entered a new stage of development, progressing from the initial exploratory attempt to the gradual joint recommendation and ultimately to the independent innovation of new energy enterprises. The primary goal of new energy enterprises in establishing an FSS system is to meet business standardization requirements, reduce costs, improve efficiency, and enhance enterprise control.

Following the establishment of the FSS system, the financial operations of 20 new energy enterprises in the city are gradually being incorporated into the FSS system. This paper investigates the effect of the FSS system in 20 enterprises. The value of the FSS system brought to enterprises by 20 new energy enterprises is shown in Table 2:

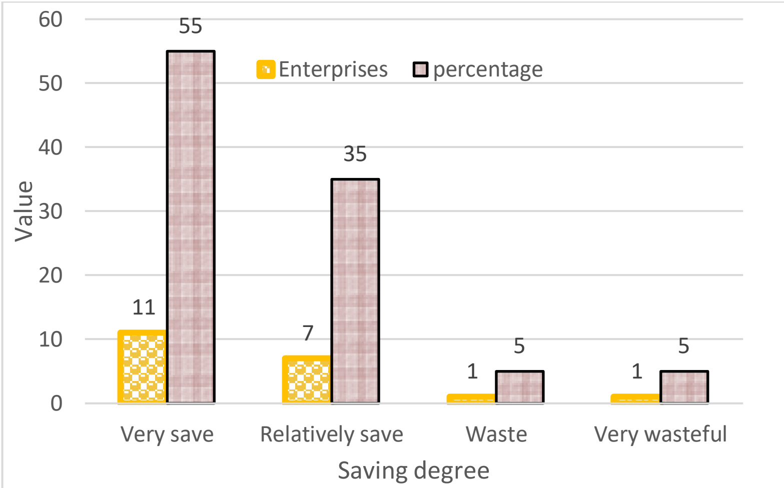
Table 2 *Value of the FSS system for enterprises*

Value brought	Number of enterprises	Percentage
Standardize company management	6	30%
Financial value improvement	4	20%
Improvement of decision support capability	3	15%
Enhanced ability to negotiate with other countries	7	35%

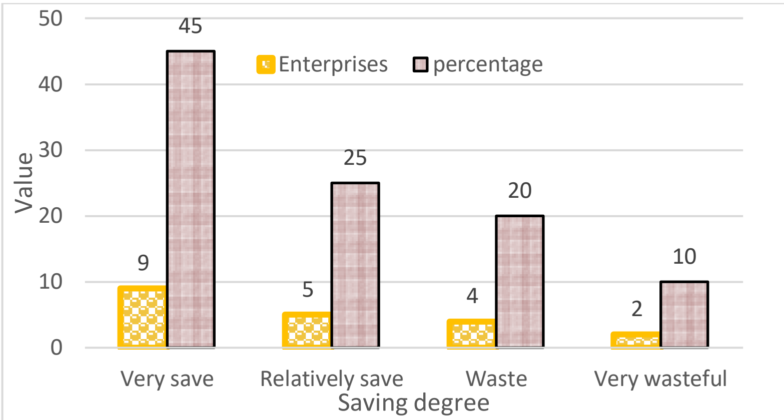
As shown in Table 2, according to the knowledge of enterprises on the FSS system, after the implementation of FSS, six enterprises believe that the system standardizes enterprise management, accounting for 30%. Four enterprises believe that the system can improve the financial value of their operations, accounting for 20%, and three enterprises believe that the system can enhance the decision-making support ability of their operations, accounting for 15%. Seven enterprises believe that the system enhances their ability to negotiate with others, accounting for 35%.

The FSS system is the key to promoting the overall operation level of enterprise financial organizations. It can not only save costs, but also free up a large number of financial talents to engage in high-value-added work. This can transform financial institutions from accounting to value management and decision support, thus promoting the overall value of enterprises.

Through the implementation of FSS, people can save manpower and realize cost savings. Initially, every enterprise needs to have a complete financial department and staff. With this system, the financial management of each enterprise can be unified, thereby achieving a positive outcome. The saving of time and human resources under the FSS system is shown in Figure 9:



(a) Time saving



(b) Saving of human resources

Fig. 9 *Savings in time and human resources*

As shown in Figure 9, in the survey regarding time savings in (a), 11 new energy enterprises believe that using the FSS system can save working time, accounting for 55%. Seven new energy enterprises think that using the FSS system can save working time, representing 35%. One new energy enterprise considers using the FSS system a waste of working time, accounting for 5%. According to (b), nine enterprises indicated that the use of the FSS system is very economical in terms of human resources, accounting for 45%. Five enterprises indicated that using the FSS system can save human resources, accounting for 25%, while four enterprises reported that using the FSS system wastes human resources, accounting for 20%. Two enterprises claimed that the use of the FSS system is a waste of human resources, accounting for 10%. With the ongoing advancement of enterprise financial standardization, the system enhances the management level of enterprises and standardizes business processes. This can simplify operational methods and improve the accuracy and reliability of financial operations.

5. Conclusions

FSS represents an innovative approach to the financial transformation of modern new energy enterprises. It standardizes and simplifies the reform of these enterprises' financial business processes, promoting and supporting their scale expansion and global development. In an era of global economic integration and continuous advancements in information technology, this paper proposes the establishment and application of the FSS system, grounded in relevant theories. This is essential for reducing costs, strengthening control, minimizing risks, and enhancing enterprise value. This paper positions the FSS system as the cornerstone of enterprise operations, standardizing the operation of various financial core businesses. From business logic to business service, it seamlessly integrates various financial subsystems, significantly enhancing the efficiency of financial business processing. Most importantly, the application of the QPSO concept enhances the flexibility of the entire FSS management system, laying a solid institutional foundation for future public open services.

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Conflict of Interest

The authors declare that they have no conflict of interest regarding the publication of this paper.

Author Contribution

The author confirms sole responsibility for the following: study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

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