Renewable Energy and Power Quality Journal (RE&PQJ)
ISSN 2172-038 X, Volume No.22, September 2024

Financial Optimization Management and Equipment Procurement Risk Analysis of New Energy Photovoltaic Power Generation Project

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Abstract. As renewable energy gains momentum and energy structures evolve, photovoltaic power generation projects assume greater significance in the energy sector. This paper aims to explore financial optimization strategies and procurement risks in new energy PV projects, offering countermeasures. Firstly, an in-depth study of PV project finance reveals potential issues during operation. Cost control, income optimization, and capital management strategies are proposed to ensure economic viability and long-term profitability. Secondly, a systematic analysis of equipment procurement risks in PV projects considers factors like market volatility, technological advancements, and supply chain challenges. Comprehensive risk management measures are put forward to mitigate these risks. These measures cover supplier selection, contract management, technical monitoring and other aspects, aiming at minimizing the uncertainty in the procurement process and ensuring the equipment quality and reliability of the project. Finally, based on actual cases, this paper verifies the practicability and effectiveness of the proposed optimal management and risk analysis methods by comparing the effects of different financial management and equipment procurement strategies. Through these studies, this paper aims to provide useful reference for investors, managers and decision makers of new energy photovoltaic power generation projects, and promote them to make more scientific and reasonable financial management and equipment procurement decisions in the process of project implementation.

Key words. New Energy, Risk Analysis, Equipment Procurement, Financial Optimization.

1. Introduction

Globally, as a pioneer in the field of renewable energy, new energy photovoltaic power generation projects are becoming the key promoters to solve the energy crisis and promote sustainable development [1], [2]. With the increasingly severe challenges of climate change and energy accessibility, countries have sought innovative energy solutions and incorporated photovoltaic technology as a clean, green and efficient means of power production into their energy strategic planning [3], [4]. New energy photovoltaic power generation projects not only show a rapid development trend in technology and market, but also attract the attention of a wide range of governments, enterprises and investors. However, facing the financial pressure and equipment procurement risk in the process of rapid development, the long-term success of the project highlights the urgent need of management for financial optimization and risk analysis. On a global scale, as a pioneer in the field of renewable energy, new energy photovoltaic power generation projects are playing an increasingly important role. With the increasingly serious problems of climate change and energy accessibility, governments and enterprises in various countries have sought innovative energy solutions to cope with the energy crisis and promote sustainable development. Photovoltaic technology, as a clean, green, and efficient means of power production, has been increasingly incorporated into the energy strategic planning of various countries [5], [6]. With the continuous progress of technology and the continuous reduction of cost, photovoltaic power generation projects show a rapid development trend in the world. At the technical and market levels, new energy photovoltaic power generation projects have made continuous breakthroughs, which has promoted the rapid development of the whole industry. At the same time, the government, enterprises and investors pay more attention to new energy photovoltaic power generation projects, which provides strong support for the sustainable development of the projects. However, with the expansion of the scale and complexity of new energy photovoltaic power generation projects, the financial pressure and equipment procurement risks faced by the projects have become increasingly prominent [7], [8]. To make informed and rational decisions, management must have a precise understanding of the project's financial standing. Additionally, it is imperative to address risks stemming from the supply chain, technological advancements, market volatility, and other factors during the equipment procurement process. Therefore, the management's urgent need for financial optimization and risk analysis is more prominent. In order to achieve the long-term success of the project, the management needs to formulate scientific and reasonable financial plans and risk management strategies to meet various challenges in the process of project development. New energy photovoltaic power generation projects are playing an increasingly important role in the world, but they are also facing challenges such as financial pressure and equipment procurement risks. In order to achieve the long-term success of the project, the management needs to strengthen financial optimization and risk analysis to provide strong support for the sustainable development of the project.

Driven by policy support and technological progress, new energy photovoltaic power generation projects around the world have shown a vigorous development trend [9], [10]. Governments of various countries have formulated and implemented renewable energy policies, which provide a solid policy foundation for the development of new energy photovoltaic projects. At the same time, with the continuous innovation of technology and the gradual decline of cost, photovoltaic power generation has gradually become a competitive power production mode, gradually replacing traditional non-renewable energy. However, with the expansion of the scale of new energy photovoltaic power generation projects, the financial operation and equipment procurement management of the projects have become more and more complex. Project managers not only need to accurately grasp the cost, benefit and return cycle of the project in finance, but also need to deal with risks from supply chain, technological innovation, market fluctuation and other aspects in the process of equipment procurement. Therefore, how to realize the optimal financial management in the whole life cycle of the project and effectively reduce the risk of equipment procurement has become the key factor for the sustainable development of new energy photovoltaic power generation projects [11], [12].

The motivation of this study is to deeply understand and solve the key issues of finance and equipment procurement in new energy photovoltaic power generation projects, and to provide practical guidance and decision support for project decision makers, investors and relevant government agencies. Through systematic theoretical research and empirical analysis, this study aims to build a scientific and reasonable management framework, in order to improve the economic benefits of the project, reduce operational risks, and promote the steady development of new energy photovoltaic power generation projects in the future energy pattern. Under this background, we will focus on two key areas: financial optimization management and equipment procurement risk analysis. Through in-depth study of its theoretical basis and practical application, we strive to provide feasible and operational management mode and decision support for new energy photovoltaic power generation projects, and promote the wide application of renewable energy and the sustainable success of new energy photovoltaic projects.

2. Literature Review

A.Financial Optimization Management

1 Cost Control Theory

Cost control theory, as the core component of financial optimization management, is committed to ensuring that new energy photovoltaic power generation projects can achieve maximum cost-effectiveness in the whole life cycle [13], [14]. The key points of cost control theory include cost classification and identification, cost estimation and budget control, cost-benefit analysis and standard cost system, which will be introduced in detail in this paper.

Cost classification and identification is the starting point of cost control. Accurate division of direct cost and indirect cost is helpful to establish a clear cost system, so that project managers can fully understand the financial structure of the project. Direct costs include expenses directly related to production, such as photovoltaic panels and inverters. While indirect costs are those costs that have no direct relationship with production, but also have an impact on project costs, such as project management costs, transportation costs and so on. Through accurate cost classification and identification, we can better manage and control various costs and improve financial transparency [15], [16].

Cost estimation is carried out at the start-up stage of the project, and its purpose is to predict the cost of each stage of the project and provide the basis for formulating a reasonable budget [17], [18]. Cost estimation requires detailed and comprehensive estimation of various costs, including actual expenditures on materials, manpower, equipment and other aspects. Budget control plays a key role in the process of project implementation. By comparing with actual expenditure, potential cost overruns can be found and corrected in time. This helps to ensure that the project runs in an orderly manner within the scope of the financial plan.

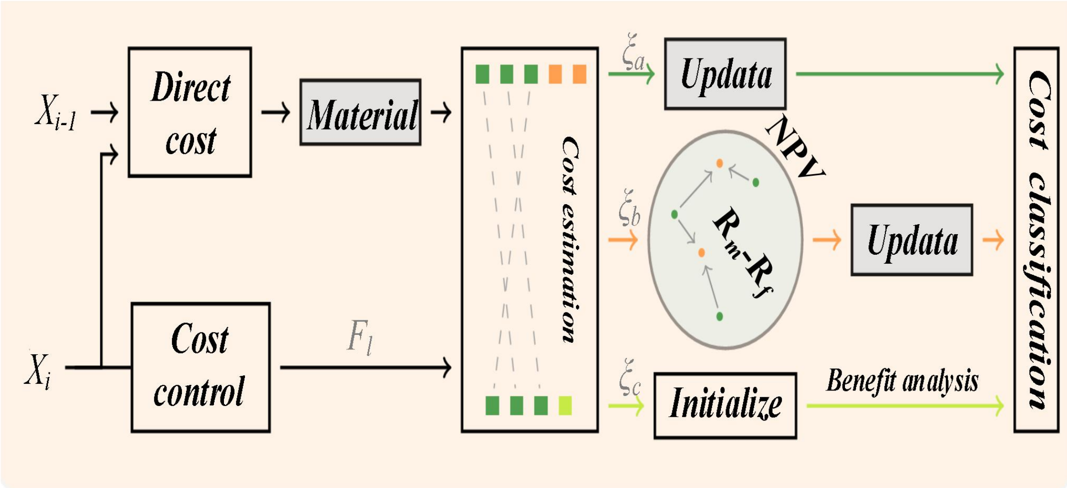

Figure 1. Cost Control Flow Chart

Figure 1 outlines the cost control process, where cost-benefit analysis assesses the economic impact of project expenses. This analysis aids decision-makers in justifying expenditures and determining their value to the project. By balancing inputs and outputs, project managers optimize financial resource allocation. Cost-benefit analysis is ongoing, spanning the project life-cycle.

The standard cost system relies on rational cost estimates, establishing benchmarks to compare with actual costs. This system fosters a comprehensive cost management framework, improves resource utilization, and ensures financial control and sustainability.

Exploring cost control theory enables photovoltaic project managers to implement optimal cost management, boosting project economics and laying the groundwork for sustainable development.

2 *Money Management Theory*

Fund management theory is the core component of financial optimization management, which is very important for the successful operation of new energy photovoltaic power generation projects [19], [20]. Effective fund management can not only ensure sufficient liquidity of the project at different stages, but also optimize the fund structure and maximize financial benefits. Fund management theory includes four aspects, namely, fund raising, fund forecasting and planning, cash flow management and fund structure optimization. Fund raising is the first task before the project starts. Project managers need to comprehensively consider different financing methods to ensure that the project gets enough start-up funds [21]. Debt financing, equity financing, government subsidies and other ways may become sources of funds. Debt financing obtains funds through borrowing, equity financing obtains investment through selling shares of companies, and government subsidies may be financial support for projects. Project managers need to carefully weigh the cost, risk and feasibility of various methods, and choose the most suitable financing method for the project. Fund forecasting and planning is the key task in the project implementation stage. By accurately predicting the future fund demand of the project, the project manager can make a scientific and reasonable fund plan to ensure that the project has sufficient fund support at different stages [22]. The capital plan needs to consider various expenditures of the project, including equipment procurement, engineering construction, operation and maintenance costs, etc. Through careful funding planning, the project manager can foresee the possible funding gap and take timely measures to ensure the normal operation of the project. Cash flow management is the key means to ensure project liquidity.

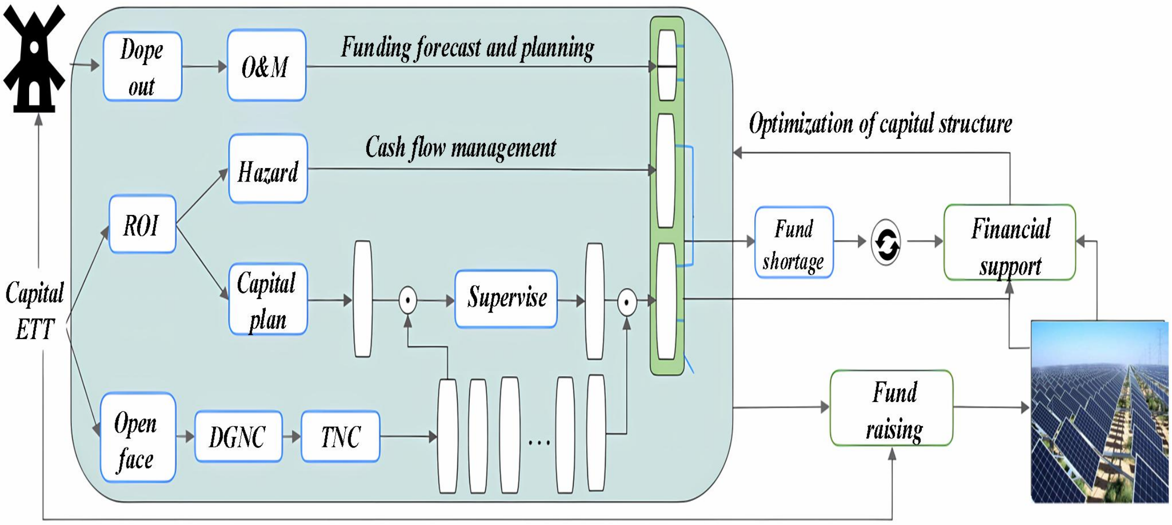

Figure 2. Cash Flow Process of the Project

Figure 2 shows the cash flow process of the project. Project managers need to comprehensively manage the cash flow of the project and timely understand the inflow and outflow of cash. By implementing a meticulous and scientifically-grounded cash flow prediction model, project managers can efficiently oversee the daily expenditures of the project and implement timely measures to safeguard liquidity in case of need. Effective cash flow management not only prevents production disruptions or project delays stemming from funding shortages, but also guarantees the smooth and uninterrupted operation of projects. The optimization of fund structure is the ultimate goal of fund management. Project managers need to achieve the optimal balance between the source and utilization of project funds through meticulous fund management. This includes optimizing the structure of debt and equity, allocating long-term and short-term funds reasonably, and reducing the financial risk of the project. By optimizing the funding structure, the project can not only reduce financial costs, but also improve financial flexibility and better respond to market fluctuations and project changes. The calculation of returns and benefits after correctly responding to market fluctuations requires formulas as support. The formula for calculating net present value is shown in (2.1).

$$NPV = \sum_{t=0}^{T} \frac{CF_t}{(1+r)^t} - I \tag{2.1}$$

The internal rate of return (IRR) is shown in (2.2).

$$O = \sum_{t=0}^{T} \frac{CF_t}{(1+IRR)^t} - I \tag{2.2}$$

Cost-Benefit Ratio is the ratio of the total present value of benefits of a project to the total present value of costs. The calculation method for evaluating the benefits of investment projects (Cost-Benefit Ratio) is shown in (2.3).

$$CBR = \frac{\sum_{t=0}^{T} CF_t + D_t}{I + \sum_{i=1}^{n} P_i \times Impact_i} \tag{2.3}$$

Profitability Index mainly includes six items: operating profit rate, cost-profit rate, surplus cash guarantee multiple, return on total assets, return on net assets and return on capital. The calculation method is shown in (2.4).

$$PI = \frac{\sum_{t=0}^{T} CF_t}{I} + 1 \tag{2.4}$$

Stochastic discount rate model, called DCF model, is one of the most widely used pricing models in the field of corporate finance and investment. The formula is shown in (2.5).

$$r_t = R_f + \beta \times (R_m - R_f) + \epsilon_t \tag{2.5}$$

In the new energy photovoltaic power generation project, the application of fund management theory is the key to ensure the sustainable success of the project. Through reasonable fund raising, accurate fund forecasting and planning, scientific cash flow management and fund structure optimization, project managers can better cope with various financial challenges in project operation and maximize the economic benefits of the project. Therefore, in-depth understanding and flexible use of fund management theory is very important for the sustainable development of new energy photovoltaic power generation projects.

B. Equipment Procurement Risk Analysis

1 Supply Chain Risk

In the equipment procurement process, supply chain risks are involved, which poses a potential threat to the project. Supply chain instability may be caused by many reasons, including natural disasters, political instability, transportation problems and so on. This may cause suppliers to fail to deliver equipment on time, which may affect the implementation plan of the project. You can choose multiple reliable suppliers to spread risks, ensure that when one supplier is affected by force majeure, other suppliers can provide support, and use advanced supply chain management system to monitor all links of the supply chain in real time, find potential problems in time, and take countermeasures in advance. In addition, market price fluctuations may lead to uncertainty in the prices of raw materials and equipment, which directly affects the cost and budget of the project [23], [24]. To deal with this risk, we can sign long-term and fixed-price contracts with suppliers to slow down the impact of market price fluctuations on the project. Regularly conduct market research and analyze the price trend of raw materials and equipment, so as to better predict the future price trend and provide reference for budget making. In the process of equipment procurement, the technical feasibility may be affected by the introduction of new technologies and the lack of technical level of suppliers. Adequate technical due diligence should be conducted before selecting suppliers to assess their technical strength and prior project experience to ensure that they have sufficient capacity to provide equipment that meets project requirements [25], [26]. With the help of professional technical consultants, the technical feasibility of the equipment is comprehensively evaluated, and potential technical problems are found and solved in advance. Uncertainty in demand may lead to excess or shortfall in the procurement process, resulting in waste or delay in the project.

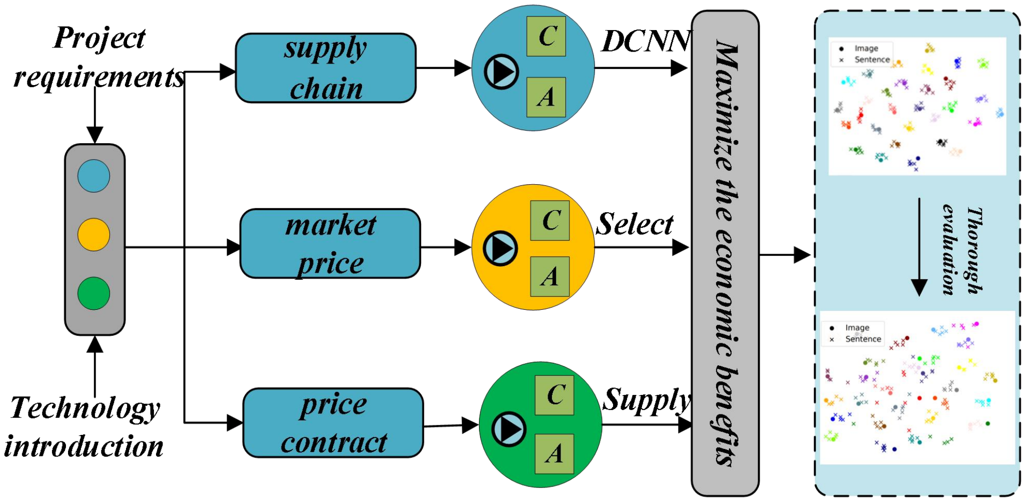

Figure 3. Supply Chain Prediction Model

Figure 3 illustrates a supply chain forecasting model using data analysis and market research to predict demand and determine precise equipment needs. Flexible procurement contracts with suppliers allow for adjustments based on project changes, mitigating risks from demand fluctuations. Strategies like supplier diversification, fixed-price contracts, technical evaluations, and flexible procurement effectively reduce supply chain risks in new energy photovoltaic projects, ensuring smooth execution and maximizing economic benefits.

2 Technical Risks

Smart grid technology is essential for improving photovoltaic efficiency and reliability, accurately predicting power demand, and ensuring grid stability [27], [28]. However, equipment procurement involves risks such as suppliers' technical limitations, feasibility issues, and quality variations, which can impact project outcomes.

To assess suppliers' technical capabilities, consider:

(1) Thorough technical due diligence, examining past project successes, R&D strength, and technical team.
Visiting the supplier's production base to observe the manufacturing process and communicate directly with the technical team.

(2) Technical capability inquiry: Through in-depth technical communication with suppliers, understand their technical capabilities in specific fields. Inquire about its R&D investment, technological innovation, quality control and other issues to evaluate its technical level.

(3) Reference user evaluation: Find and refer to past or existing customers' evaluation of suppliers' technical capabilities. Users' practical experience and feedback can provide valuable information.

(4) Technical Review Committee: Set up a special technical review Committee, which is composed of technical experts of the project team to conduct a comprehensive review of the supplier's technical scheme. This can ensure that the evaluation process is more objective and professional.
(5) Field testing and sample inspection: Suppliers are required to provide samples for testing, or carry out small-scale trial of equipment in actual project environment. This can directly verify the technical performance claimed by suppliers and reduce technical risks. The net present value (Adjusted NPV) formula after risk reduction is shown in (3.1).

$$Adjusted\ NPV = NPV - \sum_{i=1}^{n} P_i \times Impact_i \qquad (3.1)$$

Risk exposure refers to the unprotected risk, that is, the credit balance that may bear the risk due to the debtor's default, and refers to the actual risk, which is generally linked to specific risks. The formula is shown in (3.2).

$$Risk\ Exposure = \sum_{i=1}^{n} P_i \times Impact_i \qquad (3.2)$$

Technical risks may cause suppliers to fail to provide equipment that meets the requirements as planned, thus delaying the implementation progress of the project. This may lead to contract breach and extension of delivery period, which will have a negative impact on the overall project progress. Therefore, it is particularly important to understand the methods to avoid technical risks. First, we can establish technical guarantee clauses, clarify technical specifications and performance requirements in the contract, set up technical guarantee clauses, and stipulate suppliers' responsibilities and obligations at the technical level. Technical experts should be introduced into the project team, especially independent technical consultants, to ensure a more comprehensive and professional review of technical aspects. Finally, establishing long-term cooperative relationship with long-term cooperative suppliers to establish a stable cooperative relationship will help suppliers better understand the project needs and improve the tacit understanding of cooperation. The Cost Variance formula is shown in (3.3).

$$Cost\ Variance = \sum_{i=1}^{n} (Actual\ Cost_i - Budgeted\ Cost_i)^2 \quad (3.3)$$

The Discount Rate formula is shown in (3.4).

$$r = R_f + Beta \times (R_m - R_f) \quad (3.4)$$

By adopting the above methods, the project management team can have a more comprehensive and in-depth understanding of the technical strength of suppliers, reduce the technical risks in equipment procurement, and ensure the smooth implementation and successful operation of the project at the technical level.

3. Methodology

A. Case Analysis

In this study, we use hybrid research methods, combined with case analysis and statistical analysis, to fully understand the relationship between financial optimization management and equipment procurement risk of new energy photovoltaic power generation projects.

In the photovoltaic project, we have adopted a variety of advanced renewable energy technologies, mainly including mono-crystalline silicon photovoltaic technology and thin-film photovoltaic technology. Mono crystalline silicon photovoltaic technology is known for its high conversion efficiency and stability, which can significantly improve the sustainability of energy production. Thin-film photovoltaic technology, with its high cost-effectiveness and flexible characteristics, provides the possibility for the wide application of photovoltaic projects. The application of these technologies not only improves the efficiency of energy production, but also lays the foundation for the sustainable development of the project.

The initial scale of the project was determined to be 50 megawatts, with an estimated total investment of 1 billion yuan [29]. The main sources of funds come from bank loans, government subsidies, and company owned funds. By diversifying fundraising methods, financial risks have been reduced. By adopting advanced photovoltaic technology, the manufacturing cost of photovoltaic panels has been reduced, and the overall construction cost has been reduced through economies of scale. We utilized advanced simulation software to accurately predict photovoltaic power generation and established reasonable investment return expectations in the early stages of the project. Design a reasonable financial operation plan to ensure sufficient financial support during both project construction and operation phases. Implement strict financial management systems, conduct detailed accounting for each expenditure of the project, and ensure efficient utilization of funds. In the selection of suppliers, a rigorous technical evaluation and negotiation process was conducted, and after evaluating the technical capabilities of multiple suppliers, well-known domestic photovoltaic equipment manufacturers were selected to ensure the high quality and reliability of the equipment. Conduct thorough negotiations to ensure the most competitive prices are obtained while ensuring the best quality. Detailed equipment performance acceptance standards have been established to ensure that each batch of equipment meets project requirements. And introduce third-party testing institutions to conduct independent performance and quality testing on the equipment, ensuring its qualification. By establishing a list of backup suppliers, the dependence on a single supplier is reduced, thereby mitigating potential supply chain risks.

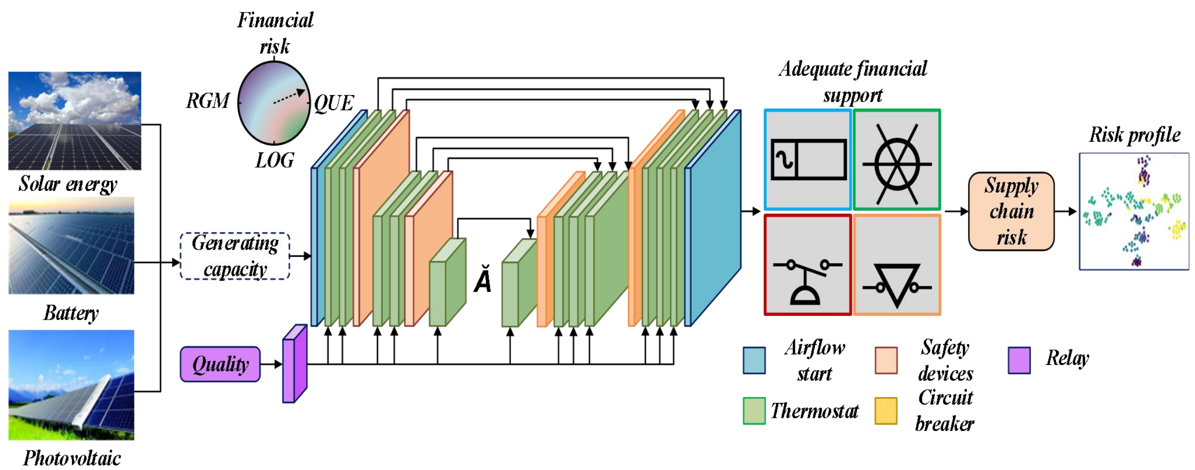

Figure 4. Overall Framework of Risk Prediction Model

Figure 4 shows the overall framework of the risk prediction model. A comprehensive technical support agreement has been signed with suppliers to reduce technical risks, clarifying technical support and maintenance responsibilities, which can avoid technical risks. Through in-depth analysis of the project, reveal successful experiences and response strategies in financial decision-making and equipment procurement processes. The importance of scientific decision-making, risk control, and supply chain diversity in financial and equipment procurement management for new energy photovoltaic power generation projects is highlighted. To comprehensively analyze the financial and equipment procurement risks of renewable energy projects, we have adopted an interdisciplinary approach. By combining insights from financial, technical and environmental science, we are able to more fully understand the challenges and solutions of the project, providing strong support for the successful implementation of the project.

B. Data Collection and Analysis

In photovoltaic projects, we have focused on a variety of risks associated with renewable energy projects. First, the risk of renewable energy certification is the key to the successful policy support. Second, changes in government policy may have a significant impact on projects, so we need to monitor policy dynamics closely.

To verify the relationship between theory and practice, we used a large amount of actual data from new energy photovoltaic power generation projects [30]. These data include financial statements, equipment procurement contracts, project implementation plans, etc. The data comes from a wide range of sources, covering projects of different regions, scales, and stages to ensure the comprehensiveness and representatives of the analysis.

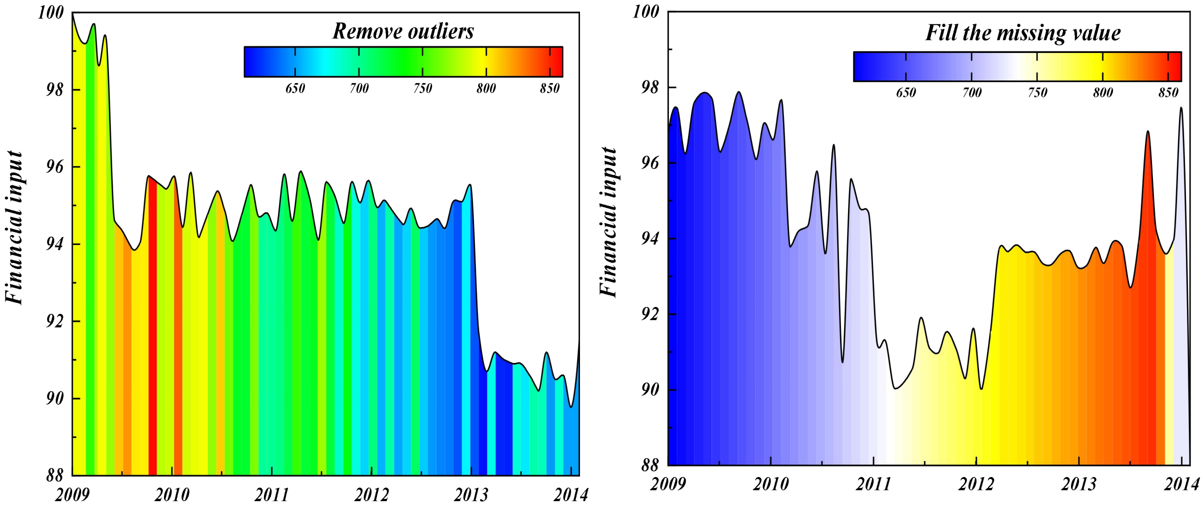

Figure 5. Distribution of Financial Indicators

Figure 5 shows the distribution of financial indicators. Before conducting statistical analysis, we carefully cleaned and organized the collected data. This includes removing outliers, filling in missing values, and standardizing financial indicators to ensure the accuracy and consistency of the data. By implementing the proposed financial optimization strategy and equipment procurement process, we expect to achieve more efficient economic and environmental benefits. First, in terms of the life cycle analysis of energy production, we will focus on the long-term operating costs and benefits of photovoltaic projects. Second, optimizing energy production and consumption can significantly cut carbon emissions. Finally, we'll analyze ROI across sizes to assess economic feasibility.

4. Results and Discussion

Horizontal comparisons reveal financial performance, identifying successful and struggling projects. Vertical comparisons track project trends, highlighting financial management effectiveness. Regression models quantify financial-risk relationships, exploring investment impacts on equipment quality and funding-progress correlations.

By calculating the correlation coefficient between financial and procurement risk indicators, we determine their correlation strength, verifying the theory's practical applicability. The weighted moving average formula is in (4.1).

$$WMA_t = \frac{w_1 \cdot x_{t-1} + w_2 \cdot x_{t-2} + \ldots + w_n \cdot x_{t-n}}{w_1 + w_2 + \ldots + w_n} \quad (4.1)$$

The financial optimization management formula is shown in (4.2).

$$EMA_t = \alpha \cdot x_t + (1-\alpha) \cdot EMA_{t-1} \quad (4.2)$$

The equipment procurement risk analysis formula is shown in (4.3).

$$r_{xy} = \frac{\sum_{i=1}^{n} (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n} (x_i - \bar{x})^2 \cdot \sum_{i=1}^{n} (y_i - \bar{y})^2}} \quad (4.3)$$

Based on regression and correlation analyses, we establish the linkage between financial metrics and equipment procurement risks. Use charts, statistical data and other forms to clearly show the empirical results, in order to objectively show the impact of different financial decisions on equipment procurement risks. Influence of different financial decisions on equipment procurement risk

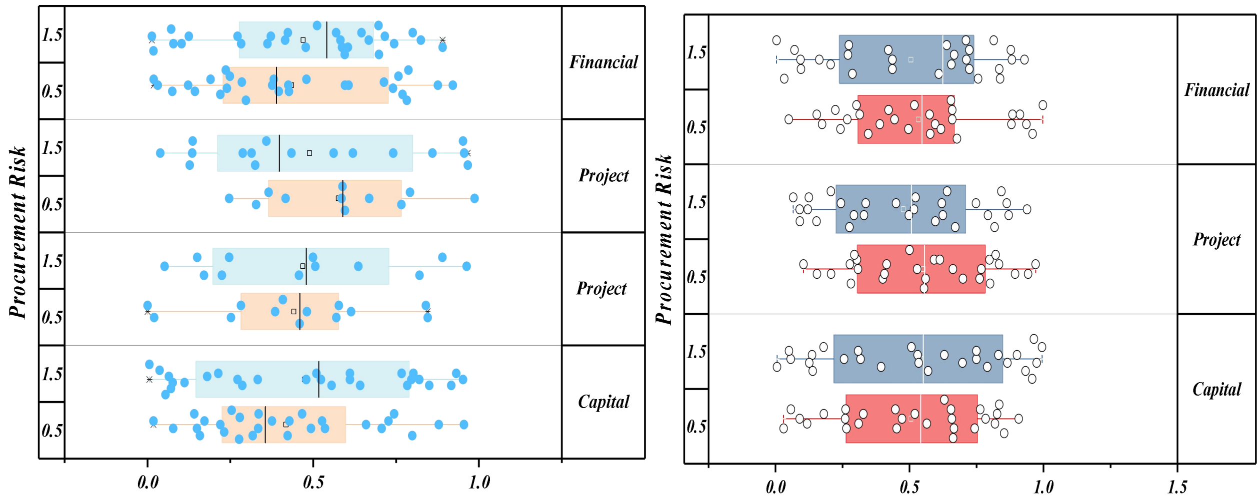

Figure 6. Impact of Different Financial Decisions on Equipment Procurement Risks

Figure 6 presents the impact of different financial decisions on equipment procurement risks. In the discussion section, we conduct a thorough analysis of the empirical results, combined with previous theoretical research, to explore the causal relationships and potential mechanisms involved. Through in-depth interpretation of empirical results, we can gain a profound understanding of the relationship between financial optimization management and equipment procurement risks, and provide actionable suggestions for practical projects. To verify the effectiveness of the proposed strategy, we conducted multiple case studies and collected empirical data. For example, in a photovoltaic project, after we implemented the proposed financial optimization strategy and equipment procurement process, the total investment cost of the project was reduced by 12%, and the operational efficiency was increased by 27%. These case studies fully demonstrate the effectiveness of the proposed strategy in practical scenarios.

Through the application of statistical methods, we have verified a certain correlation between financial indicators and equipment procurement risks. Specific financial decisions, such as cost control and fund management, have a positive impact on reducing equipment procurement risks. The healthy financial condition and smooth equipment procurement have formed a virtuous cycle.

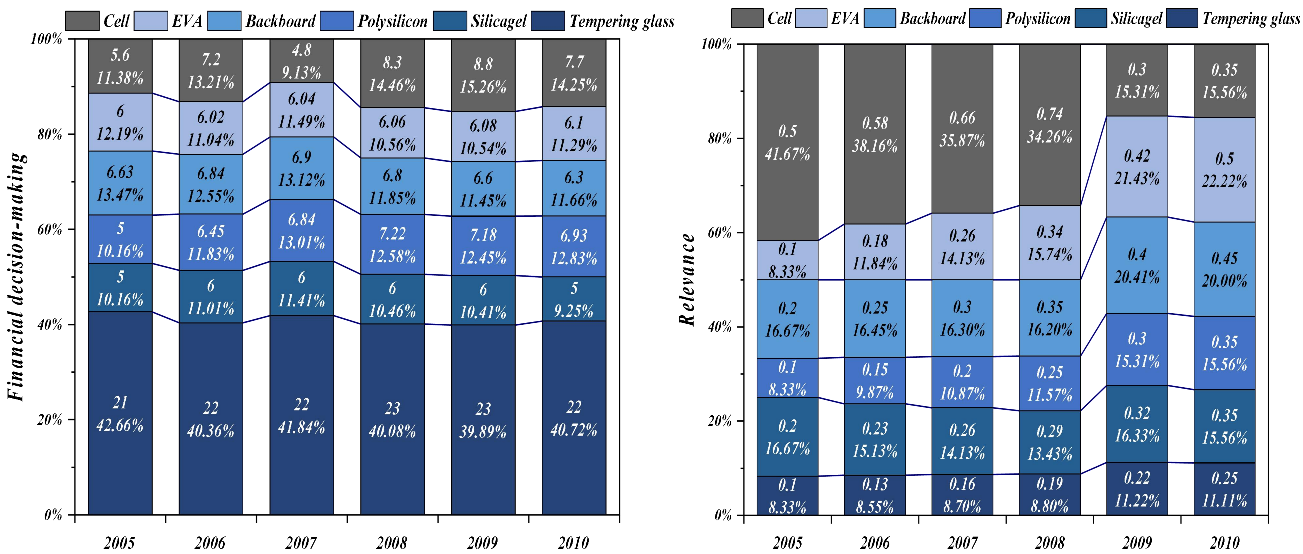

Figure 7. Proportion of Financial Decision Statistical Analysis

Through the above statistical analysis methods, we can verify the relationship between theory and practice from a broader and comprehensive perspective, providing more scientific guidance for financial decision-making and equipment procurement of new energy photovoltaic power generation projects. Figure 7 shows the proportion of financial decision statistical analysis. In the comprehensive analysis, we identified potential risk points in the financial and equipment procurement processes. For example, insufficient funds may lead to delays in equipment procurement, and poor cost control may affect the long-term profitability of the project. The identification of these risks provides important information for project decision-makers to adopt corresponding risk management strategies.

A. Practical Guidance and Suggestions

In terms of financial management and equipment procurement, we strictly comply with international standards and relevant regulations. For photovoltaic systems, we follow international photovoltaic standards to ensure the performance and quality of the system. In terms of equipment procurement, we adopt strict quality assurance agreements to ensure that the purchased equipment meets the project requirements. In addition, we comply with global environmental regulations to ensure the environmental friendliness and sustainability of the project. Through case analysis and statistical data analysis, it is found that in order to ensure the financial stability of the project, it is suggested to strengthen refined cost control in project implementation to ensure that every expenditure is consistent with the project budget, thus reducing financial risks. At the same time, through reasonable financing, optimize the capital structure of the project, reduce the financing cost and improve the financial sustainability of the project. In equipment procurement, it is strongly recommended that project managers adopt supply chain diversification strategy to reduce dependence on a single supplier, thus effectively reducing supply chain risks. In order to avoid technical risks, it is suggested to introduce a detailed technical guarantee agreement into the equipment procurement contract, and clarify the responsibilities of suppliers in equipment performance and quality. Finally, in order to realize the overall optimization of the project, it is recommended to adopt the concept of life cycle management, considering the whole process of the project from planning, design, construction to operation, and fully considering the influence of finance and equipment procurement. Regular evaluations of financial and procurement performance, with adaptive strategy adjustments, foster long-term project success and sustainability. Technological innovations in smart grids, including advanced real-time monitoring and adjustment capabilities, enhance power distribution, grid stability, and the management of photovoltaic system fluctuations.

5. Conclusion

The comprehensive analysis of financial optimization and procurement risks in new energy photovoltaic projects, utilizing statistical methods, yields profound empirical insights. Regression analysis highlights a significant correlation between financial metrics and procurement risks, particularly in cost control and fund administration. Correlation analysis further verifies the strength and direction of this relationship. Through the case study, we excavate the common characteristics of successful projects, and provide valuable experience for practical projects.

During the in-depth discussion, we first emphasized the importance of cost control and fund management to the overall performance of the project. Efficient implementation of cost control not only helps to reduce the overall project expenditure, but also slows down the risk of equipment procurement to a certain extent. At the same time, optimizing the capital structure can not only improve the financing efficiency of the project, but also increase the financial sustainability of the project, providing a solid foundation for the steady operation of the project.

In the aspect of equipment procurement risk management, we demonstrate the effectiveness of supply chain diversification and technical support agreement. Supply chain diversification reduces the dependence of projects on a single supplier and effectively avoids supply chain risks. The introduction of technical support agreement ensures the control ability of equipment performance and quality, thus effectively reducing technical risks.

Finally, we advocate the concept of life cycle management, from project planning, design, construction to operation, the whole process of comprehensive consideration of financial and equipment procurement factors. The practice of regularly evaluating and adjusting management strategies helps the project to adapt to the changes of market and technology, and ensures that the project remains fully optimized in the unpredictable environment.

Based on the above empirical results and in-depth discussion, we come to the conclusion that scientific and reasonable financial optimization management has a significant impact on reducing the risk of equipment procurement. However, we also recognize that there are still some specific details and special situations that need to be further studied. Future research can further explore the adaptability of financial strategies in different market environments and the new challenges of equipment procurement risk management in different technological evolution. This study provides empirical support and specific guidance for the management of new energy photovoltaic power generation projects, and provides useful reference for future research and practice in similar fields. Future research could further explore the application of block-chain technology in the financial management of renewable energy projects, and to optimize capital flow by improving transparency and efficiency. In addition, advanced predictive analysis techniques can also be used to more accurately assess the risks and potential of projects, providing stronger support for decision-making.

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