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Current Status and Strategies for Financial Risk Prevention and Control in the Aerospace System

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Abstract: In the current era of globalization and rapid technological development, the aerospace system, as a core area of national strategic development, its financial risk prevention and control work not only concerns the stable operation of the aerospace industry, but also has a profound impact on the overall economic security and technological progress of the country. This article provides an in-depth and comprehensive discussion on the current situation of financial risk prevention and control in China's aerospace system, detailing the progress of current work, phased achievements, and macro environmental changes faced. However, in in-depth research, it has been found that China's aerospace system still faces many severe challenges in financial risk prevention and control. The imperfect prevention and control system leads to a lack of systematic and forward-looking risk response; The lag in prevention and control technology makes it difficult to accurately identify and effectively handle new financial risks; The shortage of professional talent has made prevention and control work face many difficulties in practical implementation. Based on this, this article combines the actual situation and proposes a series of practical and feasible response strategies from multiple dimensions, aiming to further improve the financial security level of China's aerospace system, strengthen the financial risk defense line, and promote the high-quality and sustainable development of the aerospace industry.

1. Introduction

In the current era of rapid global scientific and technological advancement, the aerospace system, as a national strategic high-tech industry, not only represents a country's scientific and technological prowess but also has a profound impact on national security, economic development, and international competitiveness. In recent years, countries have continuously increased their investments in the aerospace sector, and the commercial space market has shown vigorous growth. According to relevant data, the global aerospace industry has seen steady growth over the past few years and is expected to maintain a high growth rate in the coming years.

The development of the aerospace system heavily relies on strong financial support. From the preliminary research and development of aerospace projects, through the manufacturing of satellites, and all the way to their launch, operation and maintenance afterward, each stage requires

considerable capital investment. For instance, the cost of a single satellite launch mission can reach hundreds of millions or even billions of yuan. However, the aerospace industry is characterized by substantial investment, high risk, and long cycles, which exposes the aerospace system to various financial risks during its development.

Once these risks materialize, they can not only result in significant economic losses for aerospace enterprises, but also hinder the smooth progress of aerospace projects, thereby affecting the implementation of national aerospace strategies. Therefore, strengthening research on financial risk prevention and control in the aerospace system is crucial for ensuring the stable development of the aerospace industry and enhancing national aerospace capabilities.

2. Current Status of Financial Risk Prevention and Control in the Aerospace System

2.1 Existing measures for financial risk prevention and control in the aerospace system

2.1.1 System construction

A relatively comprehensive financial risk prevention and control system has been established within the aerospace system, covering key areas like financing, investment, and capital operations. In terms of financing system, the approval process for corporate financing, criteria for selecting financing channels, and limits on financing scale are clearly specified. Aerospace enterprises seeking bank loans must undergo rigorous internal approval processes, including project feasibility assessments and financial status reviews, in order to ensure that financing projects possess excellent economic benefits and debt repayment capabilities. When selecting financing channels, priority is given to cooperation with reputable and financially robust institutions, thereby reducing financing risks.[1]

In terms of investment management system, aerospace enterprises have formulated detailed investment decision-making processes and risk assessment standards. Before making investments in an aerospace project, a specialized team conducts a thorough evaluation of the project's technical feasibility, market prospects, and financial benefits. Analysis of numerous project investment cases shows that strict investment management systems enable enterprises to make scientifically grounded and cautious investment decisions, effectively avoiding the risks from reckless investments. Major investment projects must undergo expert argumentation and collective decision-making, so as to ensure the rationality and impartiality of investment decisions.

The capital operation management system focuses on the safety and liquidity of capital. Enterprises have established comprehensive capital budgeting systems to accurately plan income and expenditures, allocate funds rationally, and ensure the stability of the capital chain. During the capital receipt and payment process, a strict approval system is enforced, and the monitoring of capital flows is strengthened to prevent the misappropriation or misuse of funds. By optimizing its capital operation management system, an aerospace enterprise has significantly enhanced capital efficiency, thereby reducing the capital idle rate by [X]% and effectively improving its economic returns.

2.1.2 Operation of risk warning mechanisms

The risk warning mechanism in the aerospace system is primarily implemented through real-time monitoring and analysis of a series of key indicators. These indicators include both financial and non-financial metrics. Financial indicators such as the debt-to-asset ratio, current ratio, and quick ratio reflect the financial status and debt repayment capacity of enterprises. Non-financial indicators, including market share, technological innovation capability, and industry competition trends, are

used for the comprehensive assessment of risks from multiple dimensions. By setting thresholds for these indicators, the warning system promptly issues an alarm when indicators deviate from normal ranges.[2] For instance, if the debt-to-asset ratio exceeds the preset safety threshold, the warning system reminds enterprises of potential debt risks, prompting the enterprises to adjust its debt structure and mitigate financial risks.

In actual operation, the risk warning mechanism has played a positive role. For example, during a period of significant market volatility, an aerospace enterprise's risk warning system issued an early market risk signal through monitoring indicators such as market share and product prices. Based on the warning information, the enterprise adjusted its marketing strategy, intensified market expansion efforts, and mitigated the impact of product price fluctuations, thereby effectively avoiding potential economic losses. However, the mechanism also has limitations. The timeliness of some warning indicators requires improvement, as certain indicators may not accurately reflect risks faced by enterprises in a rapidly changing market environment. Additionally, delays in transmitting and processing warning information, due to inadequate data sharing and coordination mechanisms between departments, affect the timeliness and effectiveness of risk prevention and control.

2.2 Issues of financial risk prevention and control in the aerospace system

2.2.1 Incomplete prevention and control system

The current financial risk prevention and control system in the aerospace system harbors deficiencies in its scope of coverage. Some emerging aerospace sectors, such as commercial space tourism and space resource development, are advancing at breakneck speed, accompanied by novel business models. However, the existing prevention and control system has failed to keep pace, lacking targeted risk identification and response measures. For instance, space tourism projects involve special risks such as ensuring tourist safety and maintaining space facility.[3] Yet, the prevention and control system may not have clearly defined responsible entities and response mechanisms, potentially leading to significant economic and reputational losses if issues arise.

The coordination mechanism of the prevention and control system is also far from seamless. The aerospace system involves multiple departments, enterprises, and institutions, but there is a lack of effective information sharing and collaboration among these groups during financial risk prevention and control. When addressing financial risks in a major aerospace project, research institutions in charge of project R&D, financial institutions providing capital support, and government departments supervising the project may fail to formulate a unified prevention and control strategy in a timely manner due to poor communication. This delay hinders timely risk resolution. Moreover, the differing risk prevention and control goals and priorities among departments, coupled with the absence of a unified coordination mechanism, prevent a cohesive effort in risk prevention and control, reducing the overall effectiveness of the prevention and control system.

2.2.2 Outdated prevention and control technologies

In terms of the application of big data technology, although the aerospace system has amassed vast amounts of data, its ability to mine and analyze data is insufficient. Many aerospace enterprises have yet to establish comprehensive data management platforms, making it difficult to efficiently integrate and analyze vast amounts of financial, market, and project data. When assessing market risks for aerospace projects, the inability to fully utilize big data technology for precise analysis of market trends and competitor conditions results in inaccurate risk assessments, failing to provide strong support for corporate decision-making.[4]

The aerospace system also lags behind in the application of artificial intelligence (AI) technologies. In risk prediction, it has not made full use of AI algorithms to model and predict complex risk factors, preventing the early identification of potential risks. In credit risk assessment, AI could analyze vast amounts of data from partner enterprises through deep learning, providing more accurate evaluations of their credit status. However, due to the lack of relevant technology applications, current credit risk assessments still rely mainly on traditional financial indicator analysis, which makes it difficult to comprehensively and accurately reflect corporate credit risks.

In comparison with advanced international aerospace organizations, the domestic aerospace system has a substantial gap in financial risk prevention and control technologies. Some well-known international aerospace enterprises have widely adopted blockchain technology to safeguard financial transactions and facilitate information sharing, using smart contracts for automated risk warning and resolution. In contrast, the domestic aerospace system is still in the exploratory stage of applying these emerging technologies, and the outdated prevention and control technologies place it at a disadvantage in dealing with complex and ever-changing financial risks.

2.2.3 Shortage of professionals

Professionals essential for financial risk prevention and control in the aerospace system should not only have a solid foundation in financial knowledge and be familiar with risk management theories and methods but also have a deep understanding of aerospace technology and the operational procedures of aerospace projects. Currently, the shortage of such interdisciplinary talents is a key factor limiting the effectiveness of risk prevention and control. According to relevant surveys, the proportion of professionals with dual expertise in finance and aerospace in aerospace enterprises is less than [X]%, making it difficult to meet the growing demand for risk prevention and control.

The shortage of professionals leads to the inability to accurately apply specialized tools and methods to quantitatively analyze complex aerospace-related financial risks during risk assessment. In evaluating investment project risks, the lack of professionals may lead to overlooking key factors such as technical risks, market risks, and capital recovery risks, resulting in inaccurate assessments that pose risks to corporate investment decisions. In terms of formulating risk response strategies, the shortage of professionals makes it difficult for enterprises to develop scientific and effective solutions. When faced with unexpected financial risks, the inability to quickly organize specialized teams for analysis and response may further exacerbate risks, causing significant losses to the enterprise.

The aerospace system's mechanisms for cultivating and attracting professionals for financial risk prevention and control are imperfect. The internal training system, which lacks systematicity and pertinence, cannot meet the demand for enhancing employees' financial risk prevention and control skills. In terms of talent recruitment, due to the specialized nature of the aerospace industry and high demands for well-rounded talents, recruiting is challenging. Additionally, the lack of attractive talent incentive policies makes it difficult to attract excellent external professionals, further exacerbating the shortage of professionals.[5]

3. Methods and Strategies for Preventing and Controlling Financial Risks in the Aerospace System

3.1 Improve risk prevention and control system

3.1.1 Optimize risk management process

In the risk identification phase, aerospace enterprises should broaden the scope and depth of risk identification. It is required to make full use of big data technology to collect and analyze various data throughout the entire life cycle of aerospace projects, including market data, technology R&D data, and supply chain data. These data mining and analysis efforts help uncover potential risk factors. For example, in a satellite manufacturing project, real-time monitoring of raw material suppliers' production and inventory data can help identify production risks in advance caused by interruptions in the supply of raw materials. On the other hand, it is required to strengthen cross-departmental cooperation by organizing professionals from finance, technology, marketing, and other departments to jointly participate in the risk identification. Professionals from different departments can identify various risks more comprehensively from their respective perspectives. The technology department can identify risks related to project delays caused by technical issues, while the marketing department can gain insights into the risks brought about by market demand changes.

In the risk assessment phase, it is required to introduce advanced quantitative assessment models and tools. For example, Monte Carlo simulations can be used to assess the potential outcomes under various risk scenarios, accurately quantifying the degree of risk for key indicators like costs and revenues. The Analytic Hierarchy Process (AHP) should also be utilized to hierarchically decompose complex risk factors, determining the relative importance of various elements and providing a more scientific basis for risk assessment. Simultaneously, dynamic adjustment of the risk assessment results should be emphasized. As the aerospace project progresses and the market environment changes, the risk situation will evolve. Therefore, timely updates to assessment data and adjustments to model parameters are essential to ensure the timeliness and accuracy of the risk assessments.[6]

When formulating risk response strategies, customized and targeted response plans should be developed based on risk assessment results. For high-risk aerospace investments, if significant technical risks are identified, a joint research and development approach can be adopted. This involves partnering with other enterprises or research institutions with relevant technical advantages to share risks and reduce individual exposure. For exchange rate risks, hedging through financial derivatives, such as entering into forward foreign exchange contracts or conducting currency swaps, can lock in the risk of currency fluctuations. Throughout the risk response process, an effective evaluation mechanism should be established to regularly evaluate and provide feedback on the effectiveness of risk response measures. This will allow timely adjustments and optimization of response strategies to ensure effective risk control.

3.1.2 Strengthen construction of internal control systems

The internal control system acts as a fundamental cornerstone, playing a key role in preventing and controlling financial risks within the aerospace system. Aerospace enterprises should establish a comprehensive and detailed internal control framework that covers every aspect of aerospace operations, from project initiation, fundraising, investment decision-making, capital operation, to profit distribution. In the project initiation phase, specific requirements for preparing project feasibility study reports, approval procedures, and responsible entities should be clearly defined to

ensure the scientific and rational basis of project initiation. Regarding fundraising, clear criteria for selecting financing channels, approval authorities for financing scales, and control targets for financing costs should be set to prevent financial risks caused by blind financing.

To ensure effective implementation of the internal control system, the internal supervision mechanism must be established and improved. An independent internal audit department should be established with professional auditors who regularly audit and supervise the execution of the internal control system. The internal audit department should be directly accountable to the board of directors and not be interfered with by other departments to ensure independent and authoritative supervision. During the audit process, the focus should be on checking whether operations comply strictly with internal control requirements. If problems are found, timely rectification suggestions should be made and implementation should be monitored.[7] At the same time, information technology should be leveraged to monitor financial data and business processes in real time, enabling the detection of abnormal situations and prompt early warnings of potential risks.

It is of utmost importance to strengthen employees' awareness of internal control. Regular training and education activities should be conducted to improve employees' understanding of the internal control system, enabling them to fully recognize the importance of internal control for both enterprise risk prevention and their individual work. The implementation of the internal control system should be incorporated into employee performance appraisals. Employees who strictly adhere to the system should be rewarded, while those who violate it should be penalized, creating an effective incentive and restraint mechanism. This will encourage employees to voluntarily comply with the internal control system, ensuring its smooth implementation and ultimately improving the overall level of financial risk prevention and control in the aerospace system.

3.2 Improve technical level of risk prevention and control

3.2.1 Use big data technology for risk monitoring

Big data technology offers powerful capabilities and has significant advantages in financial risk monitoring within the aerospace system. By establishing a big data platform, aerospace enterprises can integrate multi-source data, including internal financial data, operational data, project progress data, and external market data, industry trends, and macroeconomic data. These data cover all stages of aerospace projects, from research and development to operations, offering comprehensive and accurate information for monitoring financial risks.

In terms of credit risk monitoring, big data technology can conduct real-time analysis of massive data from partner enterprises. A credit risk assessment model is created by collecting multi-dimensional data such as financial statements, transaction records, tax affairs, and information about judicial litigation. Machine learning algorithms are applied to deeply mine these data, identifying key indicators and patterns that may signal credit risks. For instance, if a partner's financial statement shows a continuous decline in accounts receivable turnover and a significant increase in short-term liabilities, and legal disputes appear in public information, the big data system can issue a timely credit risk warning, prompting aerospace enterprises to take preventive measures, such as adjusting their cooperation strategies or enhancing accounts receivable collection, to minimize losses resulting from the credit default of partner enterprises.[8]

Regarding market risks, big data technology can monitor financial market dynamics in real time. By collecting and analyzing real-time data from stock, bond, and foreign exchange markets, as well as monitoring macroeconomic data and industry policy changes, it can promptly detect fluctuations in key indicators like market interest rates, exchange rates, and asset prices. When market interest rates rise sharply, the big data system can quickly assess its impact on the financing costs of aerospace enterprises, predict future financial pressure, and provide a basis for early adjustment of

financing strategies, such as locking in low-interest loans and optimizing debt structure, thus reducing risks from fluctuations in market interest rates. For exchange rate risks, big data technology can analyze exchange rate trends in real time for aerospace enterprises involved in international business. By combining import/export data and foreign currency assets and liabilities, it can accurately assess the impact of exchange rate fluctuations on profits and provide strong support for adopting exchange rate risk management measures such as hedging.

3.2.2 Introduction of artificial intelligence to assist in risk assessment

Artificial intelligence demonstrates significant potential in financial risk assessment within the aerospace system, significantly improving the accuracy and efficiency of evaluations. Machine learning algorithms, such as decision trees, random forests, and support vector machines, can conduct in-depth analysis of historical data from aerospace projects. By learning from large volumes of investment data, revenue data, risk event data, and more, the internal relationships and patterns between these data are uncovered, thus constructing an accurate risk assessment model. When assessing the investment risk of a new aerospace launch vehicle R&D project, multiple factors such as the project's technical difficulty, R&D cycle, market demand, and cost budget are comprehensively considered in the machine learning model. Based on the risk performance of similar projects in historical data, it predicts the potential types and levels of risks the project may face, providing a scientific basis for investment decisions.

Deep learning algorithms are particularly effective in addressing complex financial risk assessment challenges. For instance, neural networks can simulate the structure of the human brain and automatically extract features and recognize patterns from massive unstructured data. In the aerospace system, deep learning algorithms can assess market risks in satellite communication services. By analyzing unstructured text data such as industry market research reports, user demand data, competitors' technological developments, and policy and regulatory changes, deep learning models can identify key market risk factors and potential vulnerabilities, such as the impact of emerging technologies on traditional satellite communication services or the effects of policy changes on market access and competition.[9] These analyses allow for more accurate assessment of market risks in satellite communication services, providing valuable insights for enterprises to formulate market expansion strategies and optimize business operations.

Natural language processing is also crucial for AI-assisted risk assessment.When assessing financial risks of the aerospace system, natural language processing can analyze text data from news reports, social media comments, and industry forums, providing timely intelligence related to aerospace enterprises and financial risks. If negative news, such as technical failures or management changes, about a specific aerospace enterprise frequently appears, the natural language processing system can assess the potential impact of this news on the company's reputation and financial risks through sentiment analysis and other techniques. Discussions on social media regarding policy changes in the aerospace industry can also be captured, allowing the system to analyze their potential impact on aerospace enterprises, offering real-time, comprehensive support for risk assessment.

3.3 Strengthen cultivation and introduction of professionals

3.3.1 Internal talent cultivation plan

Creating a financial risk training plan for internal personnel is essential for enhancing overall prevention capabilities. The training content should cover the basic knowledge of financial risks, such as the definitions, characteristics, causes, and typical cases of various risks, including credit,

market, and operational risks. For example, through the case study of a project standstill caused by a partner's credit default, trainees can better understand the damage and prevention points of credit risks. Additionally, risk management theories and methods, including the processes and techniques for risk identification, assessment, response, and monitoring, should be explained in detail, with examples of tools such as the risk matrix method and the Value at Risk (VaR) model used in aerospace.[10]

A variety of training methods should be adopted to improve effectiveness. Online learning offers flexibility for employees to manage their own schedules. The platform should offer video lectures, online tests, and other resources, allowing employees to reinforce knowledge at their convenience. Regular offline training should also be organized, with industry experts invited to deliver face-to-face lectures. These experts can share practical risk prevention techniques and strategies. Case-study seminars should be conducted using representative financial risk cases from the aerospace system, where employees are divided into groups to analyze the causes of risks and the pros and cons of countermeasures. Improvement suggestions should be proposed, helping employees develop risk analysis and problem-solving skills through hands-on case discussions.

To ensure the continuity and effectiveness of training, an assessment mechanism should be established. Regular assessments should evaluate employees' understanding of theoretical knowledge and their case analysis skills. The results should be tied to performance appraisals, with high performers rewarded, promoted or incentivized. This system will encourage employees to actively participate in training and enhance their financial risk management capabilities.

3.3.2 Introduction strategies of external talents

Attracting external professionals in financial risk prevention and control is key to enhancing the aerospace system’s talent pool and improving risk management capabilities. Salaries and benefits should be competitive. Market conditions should be surveyed, and a salary system higher than the industry average should be formulated, with consideration for the unique traits of the aerospace industry. For senior financial risk prevention experts, high annual salaries, year-end bonuses, and equity incentives should be offered to reflect their professional value and contributions. In addition to the regular social insurances and housing fund, supplementary commercial insurance, paid annual leave, and regular health check-ups can also be provided to relieve employees’ concerns.

Expanding career development opportunities is key to attracting talents. Providing clear career promotion channels is essential for external talents, outlining promotion paths and standards from junior risk analysts to senior risk management experts. A dedicated risk management career path should be established, enabling talents to deepen their expertise and achieve their career goals.[11] Talents should be encouraged to participate in major aerospace projects and strategic decisions, offering them a broad platform to showcase their skills. For instance, in the investment decision-making process for a major aerospace project, external financial risk experts should be involved in risk assessments and plan formulation, allowing them to see the importance and value of their contributions.

To create a working environment, emphasis should be placed on fostering innovation and collaboration. Building an open, inclusive corporate culture is essential to encourage employees to propose new ideas and suggestions. Innovative concepts and methods of risk prevention and control should be supported and rewarded. Collaboration between teams should be strengthened, breaking down departmental barriers, so external talents can quickly integrate into the aerospace system’s work environment. This integration will help internal and external teams work together to promote the development of financial risk prevention and control in the aerospace system.

4. Conclusion and Outlook

4.1 Summary of research conclusions

This research focuses on an in-depth exploration of financial risk prevention and control in the aerospace system. By analyzing financial risk prevention and control, it is clear that it includes risks in areas such as financing, investment, and capital operation. The aim is to ensure the capital security of the aerospace system and the sustainable development of the industry. The analysis of different financial risks in the aerospace system shows that credit risks are attributed to poor operations of partners and market instability; market risks are influenced by financial market fluctuations and increased industry competition; and operational risks arise from internal operational errors, ineffective system implementation, personnel management issues, and challenges in departmental collaboration.

Although financial risk prevention and control measures like system frameworks and early-warning mechanisms are in place, issues remain, such as an imperfect system, outdated technology, and a shortage of professionals. Case studies of companies like Beijing Aerospace Shenzhou Intelligent Equipment Technology Co., Ltd., Wuhan Raycus Fiber Laser Technologies Co., Ltd., and Aerospace Science & Industry Financial Leasing Co., Ltd. summarize the application and effectiveness of various risk prevention strategies and models.

To strengthen financial risk prevention in the aerospace system, the following strategies are proposed: improving the risk prevention and control system, optimizing risk management processes, and enhancing the construction of internal control systems; upgrading the technical level of risk prevention, using big data for risk monitoring, and introducing artificial intelligence to assist in risk assessment; and strengthening the cultivation and introduction of professionals by formulating internal cultivation plans and strategies for attracting external talents.

4.2 Outlook on future research directions

In the future, research on financial risk prevention in the aerospace system can delve deeper into the innovation of risk prevention and control technologies. With the rise of quantum computing technology, its powerful computing capabilities may revolutionize financial risk prediction models. Exploring the application of quantum computing technology to complex financial aerospace risk models for more accurate risk trend predictions is a key focus. The application of edge computing in the aerospace system is also worth exploring. By applying edge computing on satellites, spacecraft, and other devices to process and analyze financial data in real time, it is possible to detect risk signals more quickly and take timely prevention and control measures.

Research on international cooperation risks is another important direction. With the increase in international aerospace cooperation projects, the impacts of political risks and cultural difference risks on financial risks have become increasingly significant. In-depth research is crucial on how changes in political systems and foreign policies of different countries impact capital flow and cooperation stability in aerospace projects, as well as how cultural differences trigger financial risks in contract execution and coordination. Formulating targeted risk prevention strategies will be vital for ensuring the financial security of international aerospace cooperation projects.

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