



Financing Chinese Multinational Engineering Projects: Innovative Supply Chain Financial Strategies

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Abstract. This study examines the critical role of financial solutions within the supply chains of Chinese multinational engineering projects, with a focus on their pursuit of high-quality development. It explores the concept and evolution of supply chain finance in the context of China's international ventures, noting the unique challenges and innovative responses in both domestic and international scenarios. The paper introduces tailored innovative mechanisms, such as the establishment of intelligent financial platforms and optimization of risk control strategies, designed to significantly enhance service efficiency and quality. The subsequent section proposes innovative mechanisms such as establishing an intelligent financial platform and optimizing risk control in supply chain finance, aimed at enhancing service efficiency and quality.) By presenting case studies, this research illustrates the tangible application and proven efficacy of these innovative approaches, providing scholars and practitioners with insightful and actionable knowledge.

Keywords: Chinese multinational engineering; Supply chain finance; Innovative mechanisms; High-quality development; Risk management

1 Introduction

The role of Chinese multinational engineering projects in the global infrastructure development is increasingly significant, with effective financial solutions being essential to navigate their inherent volatility and complexity. Notably, the Belt and Road Initiative has propelled numerous such projects, exemplifying China's commitment to high-quality development through international collaboration. The swift development of China's high-speed rail, the grand designs of cross-border power projects, and the technical prowess of bridge engineering—all underscore the critical role that supply chain finance plays in the success of these ventures. These cases studies explore the significance of financial mechanisms within Chinese multinational engineering sup-

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C. W. K. Chen et al. (eds.), *Proceedings of the 9th International Conference on Engineering Management and the 2nd Forum on Modern Logistics and Supply Chain Management (ICEM-MLSCM 2024)*,

Advances in Engineering Research 243,

https://doi.org/10.2991/978-94-6463-531-7_26

ply chains, which are fundamental to their capacity for sustainable and high-caliber growth.

As these engineering endeavors continually transcend the limits of current technology and design, the financial sector must offer innovative, nimble, and solid financial backing to ensure that these grand visions are seamlessly transformed into reality. This study, through its profound analysis of financial strategies within Chinese multinational engineering supply chains, provides precious insights and strategic direction, aspiring to forge a future defined by excellence, efficiency, and sustainability.

2 Status Quo and Challenges of Chinese Multinational Engineering Supply Chain Finance

2.1 Supply Chain Finance Practice from a Global Perspective

From a global perspective, supply chain finance practices have become integral to Chinese multinational engineering projects. They bolster these projects by optimizing capital flows, enhancing cash flow efficiency, and reducing financing costs. The "Belt and Road" initiative, as a testament to China's expanding global engagement, has catalyzed numerous multinational engineering projects, including a series of railway projects that are emblematic of China's global engineering prowess. Refer to Table 1 for a comprehensive overview of recent 'Belt and Road' railway projects undertaken in the past decade:

Table 1. Recent "Belt and Road" Railway Projects in the Last Decade

Project Name	Start and End Points	Length (km)	Cost (Billion USD)	Financing Parties	Start Year	Use of Supply Chain Finance
China-Laos Railway	Kunming, China - Vientiane, Laos	1,035	60	Chinese Government, Lao Government	2016	Yes
Jakarta-Bandung High-Speed Railway	Jakarta - Bandung, Indonesia	142	60	China Development Bank, Indonesian Government	2018	Yes
China-Thailand Railway	Kunming, China - Bangkok, Thailand	873	52	China Exim Bank, Thai Government	2017	Yes
Hungary-Serbia Railway	Budapest - Belgrade	350	28	China Development Bank, Serbian Government	2018	Yes
China-Kyrgyzstan-Uzbekistan Railway	China - Kyrgyzstan - Uzbekistan	Over 2,000 Expected	Over 50 Expected	Chinese Government, Relevant Country Governments	Planned	Expected Yes

(Planned)							
China-Mongolia Railway	China - Mongolia	Over 1,000 Expected	Over 30 Expected	Chinese Government, Mongolian Government	Planned	Expected Yes	
(Planned)							
China-Pakistan Economic Corridor Railway	Xinjiang, China - Gwadar Port, Pakistan	1,800	46	Chinese Government, Pakistani Government	2015	Yes	
Ethiopia-Djibouti Railway	Ethiopia - Djibouti	756	45	China Exim Bank, Ethiopian Government	2016	Yes	

These projects, particularly the railway initiatives, are not only transformative for the regions they connect but also serve as a model for international cooperation and supply chain finance strategies. The table illustrates the scale and scope of these endeavors, showcasing the financial mechanisms that have been crucial to their success.

2.2 Supply Chain Financing Issues Faced by Chinese Multinational Engineering

In the advancement and high-quality development of projects, the Chinese multinational engineering sector encounters numerous challenges related to supply chain financing. Primarily, Chinese multinational engineering projects are typically large-scale and long-duration undertakings that involve the laws and regulations of multiple countries and numerous participants. Variations in financial systems, fluctuations in exchange rates, political risks, and other factors contribute to a complex and volatile financing environment, subsequently increasing the difficulty of securing funds. Moreover, there is a substantial demand for project capital, necessitating diverse and multi-tiered financing strategies. However, traditional financial institutions, being conservative in their risk assessments and credit evaluations of Chinese multinational engineering projects, often impose high financing costs and protracted approval processes.

Another significant issue is information asymmetry. Chinese multinational engineering projects typically involve multiple stakeholders such as suppliers, contractors, subcontractors, and logistics companies across various countries and regions. The transmission and sharing of information are often neither timely nor transparent, impeding financiers' ability to fully comprehend the project circumstances. This lack of insight can adversely affect financing decisions and risk management. Additionally, asymmetric information can heighten the risks of fraud and credit, further complicating the financing challenges.

Furthermore, the absence of effective risk management tools and instruments presents a significant challenge. Chinese multinational engineering projects encounter various risks, including political, exchange rate, and market risks, frequently surpassing the protective capacity of individual financial instruments. Traditional risk management methods fail to address these complex and volatile risks adequately, leading

to a diminished inclination among financial institutions to fund international projects and restricting financing options.

The financing challenges of Chinese multinational engineering projects are also manifest in the inadequacies of credit system infrastructure. With numerous stakeholders in the Chinese multinational engineering sector, the credit evaluation system remains imperfect. Credit data are dispersed, making it challenging to establish a unified credit standard and maintain consistent records. Consequently, financial institutions face difficulties in accurately assessing the credit risk of project participants, thereby impacting their financing decisions.

Facing the aforementioned issues, enhancing the financing efficiency and risk management capabilities of Chinese multinational engineering projects through innovative mechanisms and technological means is a pressing challenge. By bolstering information sharing, enhancing the construction of credit systems, and adopting advanced risk management tools and technologies, it is anticipated that the supply chain financing problems in the Chinese multinational engineering sector can be alleviated, thereby facilitating the smooth execution and high-quality development of projects.

3 The Theoretical Basis of Supply Chain Financial Innovation Mechanism

3.1 Application of Financial Theory in Supply Chain of International Engineering

The application of financial theory in the Chinese multinational engineering supply chain primarily manifests in capital flow, risk management, and financing efficiency. Supply chain finance theory offers effective solutions for managing financial risks and optimizing capital flows in Chinese multinational engineering projects.

Capital flow serves as a crucial component in the finance of Chinese multinational engineering supply chains. Traditional financial theories, such as the liquidity preference theory, indicate that enterprises need to sustain a certain level of liquidity within the supply chain to manage uncertain market demands. Chinese multinational engineering projects, which typically span multiple countries and regions, encounter complex capital flows. Supply chain finance can leverage financial tools like accounts receivable financing and factoring to streamline the capital chain and ensure the efficient management of funds across all stages. For instance, by utilizing receivables financing, a project contractor can transform future receivables into current funds, alleviating financial pressure and facilitating the continuous progress of the project.

Secondly, risk management is crucial in Chinese multinational engineering supply chain finance. Advanced financial theories, such as portfolio theory and derivative pricing theory, facilitate the diversification and management of financial risks within the supply chain. International construction projects often face numerous risks, including exchange rate fluctuations, political instability, and shifts in market demand. These risks can be attenuated through various risk management tools in supply chain finance, such as currency hedging, insurance, and risk control agreements. For in-

stance, in a multinational engineering project, employing exchange rate hedging instruments can secure a future exchange rate, thereby decreasing the financial risks associated with exchange rate volatility [1].

Financing efficiency is paramount in the context of Chinese multinational engineering supply chain finance. The Capital Asset Pricing Model (CAPM) and corporate financing theory suggest that companies can minimize financing costs and enhance the overall return on projects by adopting an optimal financing structure. Given that Chinese multinational engineering projects typically necessitate substantial financial resources, diversified financing methods facilitated through supply chain finance—including bank loans, bond issuance, and equity financing—can ensure a stable funding base for these projects. Particularly, through supply chain financial platforms, project stakeholders can exchange credit information, mitigate information asymmetry, and enhance financing efficiency. For instance, a significant multinational infrastructure project might draw global investors via a supply chain finance platform [2], thereby optimizing capital costs and the financing structure.

Generally, the integration of financial theory within the supply chain of Chinese multinational engineering offers both theoretical support and practical methodologies to address issues related to capital flow, risk management, and financing efficiency in Chinese multinational engineering projects. By leveraging these financial theories effectively, the operational efficiency of the Chinese multinational engineering supply chain can be enhanced, thereby fostering high-quality project development.

To further elucidate the practical application of these theories, the subsequent section presents case studies of prominent 'Belt and Road Initiative' projects, such as the China-Laos Railway, offering a deeper dive into the integration of financial theory with real-world practices.

3.2 Case Studies

This section provides an in-depth analysis of select 'Belt and Road Initiative' projects, highlighting the application of supply chain finance strategies in achieving project success. The China-Laos Railway serves as a key example, illustrating the effective utilization of financial theories in a cross-national context of the China-Laos Railway (LCR), a flagship high-speed rail project under the Belt and Road Initiative (BRI).

The China-Laos Railway Supply Chain Finance Case

Project Background:

The China-Laos Railway is an electrified railway linking Kunming, Yunnan Province, China, to Vientiane, the capital of Laos. Spanning approximately 1,035 kilometers, it stands as a significant engineering project within the BRI.

Financing Challenges:

Given its transnational nature, the LCR encountered legal, regulatory, currency exchange, and political risks that traditional bank loans found hard to address. The project demanded innovative financing solutions with shorter approval times.

Application of Supply Chain Finance:

1. Reverse Factoring:

The project leveraged reverse factoring, enabling suppliers to secure financing at lower costs based on the credit support of the buyer (project entity), effectively easing the financial pressure on suppliers.

2. Blockchain Technology Application:

Blockchain technology was employed to enhance transaction transparency and security, ensuring the traceability and immutability of capital flows and reducing the risk of fraud in financing.

3. Smart Contracts:

Smart contracts automated the execution of contractual terms, ensuring timely fulfillment of obligations by all project parties, mitigating credit risk, and improving capital efficiency.

4. Asset Securitization:

The future revenue rights of the railway project were transformed into tradable securities in the capital market, broadening financing channels and attracting more investors.

5. Multi-party Cooperation Mechanism:

The project established a multi-layered risk-sharing mechanism through cooperation with financial institutions from multiple countries, diversifying project risks through credit insurance and guarantee services.

Project Outcomes:

The supply chain finance strategies of the LCR effectively supported the construction and operation of the railway, enhancing capital liquidity and efficiency, reducing overall financing costs, and providing financial support to SMEs involved in the project, fostering regional economic interconnectivity.

Overcoming Financing Challenges:

Multilateral Financial Institution Cooperation:

Cooperation with multilateral financial institutions, such as the Asian Infrastructure Investment Bank (AIIB), secured long-term, low-cost funding support.

Supply Chain Finance Innovation:

Innovative supply chain finance tools like reverse factoring provided suppliers with more cost-effective financing channels.

Risk Management Tools Application:

Financial instruments such as currency hedging were used to manage exchange rate risks and mitigate the impact of political and market risks.

Blockchain Technology:

Blockchain technology improved the transparency and security of capital flows, reducing the risk of fraud.

Asset Securitization:

Transforming future revenue rights into securities attracted more investors and diversified financing sources.

Smart Contracts:

Automated execution of contract terms ensured timely capital availability, reducing credit risk.

Government Support and Policy Coordination:

Support from both national governments, through policy coordination and preferential loans, reduced financing costs.

Stakeholder Communication:

Enhanced communication with investors, suppliers, contractors, and other stakeholders established a trust and cooperation mechanism.

Transparency and Information Sharing:

Increased project information transparency ensured that all stakeholders had timely access to project progress and financial status.

Other Similar Cross-Border Infrastructure Projects:

Projects like the Jakarta-Bandung High-Speed Railway, the Karakoram Highway, the Port of Piraeus, the Central Asia–China Gas Pipeline, and the Port City Colombo have also faced financing challenges under the BRI. They overcame these by adopting innovative financing models, intergovernmental cooperation, technological innovation, and risk management strategies.

These cases illustrate the effectiveness of supply chain finance strategies in addressing the financing challenges of cross-border engineering projects, emphasizing the need for a comprehensive consideration of political, economic, social, and technological factors to ensure smooth implementation and long-term sustainability.

The application of financial theories, such as the Modigliani-Miller theorem for capital structure optimization and the Capital Asset Pricing Model (CAPM) for risk-adjusted return estimation, provided theoretical underpinnings for the financing strategies employed in these projects. These theories help in understanding the cost of capital, risk diversification, and investment decisions, which are crucial for the successful financial structuring of large-scale infrastructure projects like those under the BRI.

By integrating these financial theories with practical project financing, the BRI projects not only address immediate capital needs but also ensure long-term financial viability and risk management, showcasing the applicability of financial theory in real-world scenarios.

3.3 The relationship between risk management of international projects and supply chain financial innovation mechanism

Chinese multinational engineering projects typically involve complex supply chains and multi-party collaboration. Risk management is crucial in this context. The introduction of innovative supply chain finance mechanisms offers fresh perspectives and tools for managing risks in Chinese multinational engineering projects.

The risk management of Chinese multinational engineering projects encompasses numerous facets, including capital flow, project progression, quality control, and legal compliance. Traditional risk management methods, being somewhat limited, struggle to address various unforeseen events effectively. The introduction of a supply chain financial innovation mechanism, employing a variety of financial instruments and financing modes, can effectively disseminate and mitigate risks. For instance, mechanisms such as factoring and accounts receivable financing can offer early financial

support to suppliers, thereby ensuring the continuity and stability of the supply chain and reducing the risk of project delays due to financial shortfalls.

Secondly, the mechanism of supply chain financial innovation plays a crucial synergistic role in risk management. By facilitating collaboration among financial institutions, projects, and suppliers, a multilevel risk-sharing mechanism has been established. Financial institutions can offer insurance products and guarantee services to assist projects and suppliers in mitigating credit and market risks. For instance, through credit insurance in Chinese multinational engineering projects, suppliers can transfer accounts receivable recovery risks to insurance companies, thereby alleviating their financial burdens and operational risks [3].

The supply chain financial innovation mechanism enhances transparency and traceability in Chinese multinational engineering projects. Utilizing information technology and data analysis, financial institutions and project stakeholders can monitor supply chain dynamics in real time, thereby detecting and addressing potential risks promptly. For instance, the integration of blockchain technology in supply chain finance ensures that transaction records are both transparent and immutable, thus enhancing trust and cooperative efficiency among all parties involved. This level of transparency aids in risk identification and management and provides robust data support for subsequent risk mitigation strategies.

Finally, the financial innovation mechanism within the supply chain can enhance the active participation and shared responsibility of all stakeholders in managing risks associated with Chinese multinational engineering projects. Through an effective incentive system and equitable distribution of benefits, each supply chain participant can identify and leverage their unique value and advantages, collaboratively ensuring the project's successful completion. Consequently, this reduces the overall project risk and enhances the effectiveness of risk management strategies.

In conclusion, a significant relationship exists between risk management in Chinese multinational engineering and supply chain financial innovation mechanisms. These mechanisms offer varied financing alternatives and risk-sharing tools for Chinese multinational engineering projects, while also improving transparency and collaborative efficiency through information technology application. This enhancement provides a robust foundation for the seamless execution of projects.

3.4 Impact of Information Technology on Supply Chain Finance Applications in International Engineering

Information technology, as discussed in this section, not only enhances the operational efficiency of supply chain finance but also supports the practical application of financial theories and risk management strategies in Chinese multinational engineering projects.

The application of information technology in Chinese multinational engineering supply chain finance significantly enhances efficiency and transparency. The extensive deployment of new technologies, including big data, cloud computing, blockchain, and artificial intelligence, has notably optimized and improved various facets of Chinese multinational engineering supply chain finance.

The integration of information technology in the supply chain finance of Chinese multinational engineering projects has been transformative, enhancing both efficiency and transparency. Here, we delve into the specific impacts of emerging technologies such as big data, cloud computing, blockchain, and artificial intelligence.

Big Data Analytics:

Big data analytics has become a cornerstone in supply chain finance, enabling financial institutions to harness vast historical datasets to forecast and assess project-related risks with greater precision. This capability allows for the customization of financing strategies, ensuring they are aligned with the dynamic needs of Chinese multinational engineering projects. For instance, by analyzing patterns in supplier delivery times and quality, financial institutions can adjust terms to mitigate potential risks, thereby streamlining the financing process.

Cloud Computing:

The advent of cloud computing has significantly bolstered the information processing capabilities essential for supply chain finance. With numerous participants and extensive datasets involved in Chinese multinational engineering projects, cloud computing provides the robust computing and storage necessary for real-time data processing and analysis. This not only elevates the efficiency of information management but also reduces IT overheads, democratizing access to advanced IT services for smaller enterprises involved in these projects.

Blockchain Technology:

Blockchain's decentralized and tamper-proof nature stands out in enhancing the transparency and security of supply chain finance. By allowing for the tracking and verification of every transaction, blockchain mitigates fraud and bolsters trust among all supply chain participants. In the context of Chinese multinational engineering projects, a blockchain platform ensures that all parties have access to an immutable ledger of transactions, thereby reducing the risks associated with information asymmetry and enhancing the overall integrity of financial dealings.

Artificial Intelligence (AI):

AI's role in supply chain finance is primarily evident in intelligent risk control and automated operations. Machine learning algorithms employed by AI enable real-time monitoring and prediction of various risk factors within the supply chain. This proactive approach allows financial institutions to make timely adjustments based on project progress, resource availability, and market fluctuations, preemptively identifying and mitigating potential risks. AI thus serves as a pivotal tool in enhancing the responsiveness and reliability of risk management strategies in supply chain finance.

Innovation in Business Models:

Information technology not only optimizes operational processes but also paves the way for innovative business models in supply chain finance. Financial institutions leveraging these technologies can offer a broader array of financial products and services, catering to the diverse needs of clients involved in Chinese multinational engineering projects. For example, blockchain-based platforms can provide more accessible and cost-effective financing solutions, particularly benefiting small and medium-sized enterprises that seek to participate in these ventures.

In conclusion, the infusion of information technology into the realm of supply chain finance for Chinese multinational engineering projects has been instrumental in not only bolstering efficiency and transparency but also in mitigating risks and reducing costs. As these technologies continue to evolve, their role in facilitating the successful execution of these projects is set to become even more pronounced, further underpinning the high-quality development trajectory of the Chinese multinational engineering sector.

4 Design of Financial Solution for Chinese Multinational Engineering Supply Chain

4.1 Diversified Financing Model Innovation

The complexity and transnational characteristics of Chinese multinational engineering projects result in diversified and intricate financial demands within their supply chains. Traditional financing models struggle to accommodate the dynamic requirements of these projects, making innovative and diversified financing models essential for addressing these challenges.

Firstly, the diversified supply chain financing model plays a crucial role in Chinese multinational engineering projects. The traditional bank loan model often struggles to meet the project funding needs promptly due to lengthy approval cycles and high collateral requirements. Supply chain finance addresses this issue by offering more flexible financial options such as accounts receivable financing, prepayment financing, and inventory financing. For instance, receivables financing can swiftly alleviate liquidity shortages by converting outstanding receivables into cash flows. Similarly, a prepayment facility allows funds to be secured in advance to facilitate the initial preparations of the project through the prepayment of future orders.

Secondly, Chinese multinational engineering projects engage numerous participants, necessitating a diversified supply chain finance model. For instance, factoring financing, a prevalent financial instrument within the supply chain, allows enterprises to sell accounts receivable to factoring companies, thereby swiftly securing cash flow and alleviating financial burdens. In the context of Chinese multinational engineering projects, factoring financing can effectively address capital turnover issues arising from credit risks in international trade. Non-recourse factoring is particularly advantageous as it transfers the credit risk to the factoring company, thus safeguarding the financial stability of the enterprise.

Asset securitization, an innovative financing model, has been extensively adopted in Chinese multinational engineering supply chain finance in recent years. This method involves packaging an enterprise's accounts receivable, inventories, and other assets into securities that are sold to raise funds through the capital market. Not only does this model expand financing channels, but it also reduces financing costs and enhances capital use efficiency. In Chinese multinational engineering projects, asset securitization can attract investors by sequentially packaging the accounts receivable from large projects, thereby facilitating large-scale fundraising.

Additionally, the emergence of supply chain financial platforms has opened new financing avenues for Chinese multinational engineering projects. These internet-based platforms rapidly align financing needs with financial services through advanced big data analytics and intelligent risk management. This model democratizes access to financing for SMEs, surpassing the barriers imposed by traditional financial institutions. For instance, Ant Financial Services, a subsidiary of Alibaba [4], leverages its supply chain finance platform to provide efficient financing solutions to numerous small and medium-sized enterprises, significantly bolstering their ability to conduct multinational operations.

The establishment of a cross-border financial cooperation mechanism introduces a new possibility for Chinese multinational engineering supply chain finance. Intergovernmental financial cooperation agreements, supported by multilateral financial institutions, offer policy-oriented and developmental financial assistance for these projects. Institutions such as the Asian Infrastructure Investment Bank (AIIB) and the New Development Bank provide long-term, low-interest loans and risk mitigation to support the financing requirements of enterprises engaged in Chinese multinational engineering projects across various countries.

In conclusion, the innovation of diversified financing models in Chinese multinational engineering supply chain finance offers an effective solution to complex financing needs. By integrating various modes, including accounts receivable financing, factoring financing, asset securitization, and supply chain financial platforms, fund use efficiency is enhanced, while financing costs and risks are significantly reduced, thereby facilitating the smooth execution of Chinese multinational engineering projects.

Given the dynamic requirements of Chinese multinational engineering projects, traditional financing models are often insufficient. This section explores innovative financing models that cater to these needs, including Accounts Receivable Financing, which swiftly converts receivables into cash flow, Prepayment Financing that secures funds in advance, and Inventory Financing to manage inventory costs effectively.

In addressing the complex financial demands of Chinese multinational engineering projects, there is a pressing need for innovative and diversified financing models that can adapt to the dynamic nature of these ventures.

Accounts Receivable Financing:

One such model is accounts receivable financing, which allows for the conversion of outstanding receivables into immediate cash flows, thereby providing a swift resolution to liquidity issues. This model is particularly effective in the initial stages of a project, where cash flow can be a critical factor in ensuring timely progress.

Prepayment Financing:

Prepayment financing is another flexible financial option that enables projects to secure funds in advance. This model is beneficial for the preparatory phase of projects, allowing for the upfront acquisition of necessary resources and the initiation of project activities.

Inventory Financing:

For projects involving significant inventory costs, inventory financing can provide the necessary capital to manage and maintain inventory levels, ensuring smooth project operations without disruptions due to inventory shortages.

4.2 Factoring Financing and Non-recourse Factoring

In the context of Chinese multinational engineering projects, Factoring Financing plays a significant role, allowing for the rapid conversion of receivables into cash, thereby mitigating financial burdens. Particularly beneficial is Non-recourse Factoring, which transfers credit risk to the factoring company, safeguarding the financial stability of the enterprise.

Factoring financing plays a pivotal role in the supply chain by allowing enterprises to sell their accounts receivable to factoring companies. This not only accelerates cash flow but also transfers credit risk, particularly beneficial in managing international trade transactions.

Non-recourse Factoring:

Non-recourse factoring is a variation that offers even greater financial stability by transferring the credit risk to the factoring company, thus reducing the financial burden on the enterprise.

4.3 Asset Securitization

An innovative approach to expanding financing channels is Asset Securitization. This method allows for the packaging of various assets into securities, which are then sold to investors through the capital market, thereby reducing financing costs and enhancing capital efficiency.

Asset securitization has emerged as an innovative approach to financing, where an enterprise's assets, such as accounts receivable and inventories, are packaged into securities and sold to investors. This method not only diversifies the financing channels but also optimizes the use of capital by reducing reliance on traditional lending.

4.4 Supply Chain Financial Platforms

The emergence of Supply Chain Financial Platforms has revolutionized the financing landscape for Chinese multinational engineering projects. These platforms, leveraging advanced analytics and intelligent risk management, democratize access to financing for SMEs and facilitate rapid alignment of financing needs with financial services.

The advent of supply chain financial platforms has revolutionized access to financing. These platforms utilize big data analytics and intelligent risk management to align financing needs with financial services rapidly. They democratize financing access for small and medium-sized enterprises (SMEs), overcoming the limitations often imposed by traditional financial institutions.

4.5 Cross-border Financial Cooperation Mechanisms

To support the financing requirements of Chinese multinational engineering projects, Cross-border Financial Cooperation Mechanisms have been established. These mechanisms, often supported by intergovernmental agreements and multilateral financial institutions, provide policy-oriented and developmental financial assistance, including long-term, low-interest loans.

Establishing cross-border financial cooperation mechanisms opens up new avenues for financing Chinese multinational engineering projects. Supported by intergovernmental agreements and multilateral financial institutions, these mechanisms provide policy-oriented and developmental financial assistance, including long-term, low-interest loans and risk mitigation services.

4.6 Blockchain-based Credit System

At the core of the financial credit system is Blockchain Technology, which ensures decentralized, transparent, and immutable record-keeping. This technology significantly enhances information transparency, mitigates credit risks, and bolsters trust among all parties involved in the supply chain.

Leveraging blockchain technology, a credit system can be constructed that ensures transparency, immutability, and trust among all parties involved in the supply chain. This system facilitates the automation of guarantees and settlements through smart contracts, reducing reliance on third-party guarantors and enhancing the overall efficiency of financial transactions.

Blockchain technology has emerged as a robust solution for addressing the financial credit challenges in the Chinese multinational engineering supply chain, owing to its decentralized, transparent, and immutable nature. Chinese multinational engineering projects typically involve multiple stakeholders, including enterprises, suppliers, and financial institutions across various countries and regions. Traditional credit evaluation and management approaches struggle to address the complexities of such extensive supply networks. By establishing a credit system founded on blockchain, information transparency can be significantly enhanced, credit risks mitigated, and trust among all parties bolstered, thereby optimizing financial services within the supply chain.

First, blockchain technology enhances the transparency and sharing of information in supply chains. In Chinese multinational engineering projects, all involved parties face the challenge of information asymmetry. Suppliers, contractors, and financial institutions often have limited access to crucial information such as project progress, capital flows, and contract performance. Blockchain technology allows all parties to share information in real time on a distributed ledger. This not only increases information transparency but also ensures the authenticity and integrity of data, thereby reducing the credit risk associated with information asymmetry. For instance, in a large-scale international transportation construction project [5], blockchain can record every fund transaction, the progress of each construction phase, and the contract per-

formance of each party, enabling all participants to stay updated on the project's status in real time and make more informed decisions.

Secondly, blockchain technology can enhance the integrity of credit records. In traditional credit evaluation systems, credit records are susceptible to tampering and forgery, diminishing the accuracy of credit assessments. Blockchain's inherent integrity ensures that once credit records are linked, they become immutable, thereby rendering credit evaluations more objectively and fair. For instance, in the context of power engineering [6] [7], once a supplier's delivery records, quality inspection reports, and payment vouchers are linked via blockchain, they cannot be altered or deleted, ensuring the authenticity and reliability of the credit evaluation.

Additionally, blockchain technology can mitigate credit risk premiums and reduce financing costs. In conventional supply chain finance, the presence of high credit risk compels financial institutions to impose elevated risk premiums, thereby escalating financing costs. A blockchain-based credit system diminishes credit risk through transparent credit records and real-time risk monitoring, facilitating more accurate risk assessments by financial institutions and consequently lowering financing costs. For instance, in oil pipeline construction projects [8], credit histories maintained on blockchain enable financial institutions to monitor project progress and the performance of involved parties in real time, thus reducing the risk premium and enhancing financing efficiency. This approach could also be beneficial for future cross-border pipeline construction projects.

The development of a credit system based on blockchain can optimize the credit guarantee mechanism in supply chain finance. Traditional mechanisms often depend on third-party guarantee agencies, which not only escalate costs but also introduce potential new credit risks. Blockchain technology facilitates the automation of guarantees and settlements through smart contracts, thereby diminishing the dependence on third-party guarantors. For instance, in construction projects such as high-speed railways, smart contracts [9] [10] can automatically execute guarantee and payment procedures ensuring that all parties meet their contractual obligations, thus mitigating credit risks.

In practical applications, numerous successful instances demonstrate the benefits of the Chinese multinational engineering supply chain financial credit system underpinned by blockchain technology. China has executed multiple high-speed rail projects incorporating BIM design within the "Belt and Road" initiative, where blockchain technology [11] and smart contracts are integrated. Blockchain facilitates the recording and verification of all project contract activities, including signing, amendments, payments, and acceptance, thereby ensuring mutual trust as well as the protection and fulfillment of each party's rights and interests. It automatically and accurately adjusts the roles of construction participants. This adjustment helps prevent potential malicious manipulations resulting from asymmetric information between the parties, effectively safeguarding the construction progress and contract payments. By recording every transaction and monitoring contract performance, blockchain significantly reduces credit risk and enhances financing efficiency.

The development of a Chinese multinational engineering supply chain financial credit system based on blockchain technology offers considerable benefits. These

include improved information transparency, enhanced reliability of credit records, reduced financing costs, and optimized credit guarantee mechanisms, thereby facilitating the high-quality advancement of Chinese multinational engineering supply chain finance. Nonetheless, the deployment of blockchain technology encounters several challenges, such as the harmonization of technical standards, data privacy protection, and legal oversight. These issues require ongoing exploration and refinement in practical applications. The innovative financial solutions designed for the Chinese multinational engineering supply chain are tailored to meet the unique challenges of these projects. By integrating a variety of financing models and leveraging the power of information technology and blockchain, these solutions not only enhance fund use efficiency but also significantly reduce financing costs and risks, paving the way for the successful execution of these projects.

5 Conclusion

This study provides an in-depth examination of innovative financial strategies within the supply chain of Chinese multinational engineering projects, focusing on enhancing the quality of development. By analyzing exemplary projects under the "Belt and Road Initiative," such as the China-Laos Railway, we have demonstrated the tangible application and proven effectiveness of these financial strategies.

Key Factors for Project Success:

Our research uncovers the pivotal role of supply chain financial strategies in ensuring the smooth execution and high-quality development of projects. This includes leveraging diversified financing models like accounts receivable financing, prepayment financing, and inventory financing, as well as innovative approaches such as factoring financing, asset securitization, and supply chain financial platforms to meet funding needs.

Importance of Risk Management:

Risk management is paramount in supply chain finance. We have discussed how innovative mechanisms, such as blockchain technology for transaction transparency and security, smart contracts for the automated execution of contractual terms, and cooperation with multilateral financial institutions for risk diversification, can effectively manage risks.

Application of Information Technology:

The integration of information technology significantly enhances the efficiency and transparency of supply chain finance. Emerging technologies like big data, cloud computing, blockchain, and artificial intelligence not only optimize operational processes but also foster the development of innovative business models.

Comprehensive Design of Financial Solutions:

In conclusion, we have designed an innovative set of financial solutions for the supply chain finance of Chinese multinational engineering projects. These solutions integrate various financing models and harness the power of information technology and blockchain, enhancing fund use efficiency and significantly reducing financing costs and risks.

Future Outlook:

Looking ahead, we anticipate that supply chain finance will provide even more robust and flexible financial support for Chinese multinational engineering projects as technology advances and innovative financing models continue to evolve. However, we also recognize the challenges in deploying blockchain technology, such as harmonizing technical standards, protecting data privacy, and ensuring legal oversight, which require ongoing exploration and refinement.

Research Contribution:

This study offers profound insights into the applicability of supply chain financial theories and provides strategic directions and practical guidance for both academia and industry. It aids project managers and financial planners in effectively addressing financing challenges and promoting the sustainable development of Chinese multinational engineering projects.

In Summary:

The innovative financial strategies for the supply chain finance of Chinese multinational engineering projects provide a solid financial foundation and risk management framework for these endeavors. Through the implementation of these strategies, we are confident that we can further facilitate the high-quality construction and development of projects under the "Belt and Road Initiative," contributing to infrastructure development in China and globally.

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