

Application and Prospect Analysis of Blockchain in Digital Currency Cross-In Payment-Taking Ripple as an Example

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Abstract: With the acceleration of global economic integration, traditional cross-border payment systems have struggled to meet the demands of the modern era due to inefficiencies, high costs, and a lack of transparency. Blockchain technology, characterized by decentralization, immutability, and high efficiency, has emerged as a promising solution to reform and enhance these systems. This paper focuses on Ripple as a case study to examine its technological framework and practical applications in cross-border payments. Employing a combination of literature review and case study methods, the research analyzes Santander Bank's "One Pay FX" project as a representative example to explore the operational mechanisms and effectiveness of the Ripple network in real-world payment scenarios. The findings indicate that Ripple can significantly enhance the efficiency of cross-border transactions, reduce transaction costs, and improve transparency. This study contributes to a deeper understanding of the practical implementation of blockchain-based cross-border payments and offers theoretical insights and practical guidance for the digital transformation of global payment systems.

Keywords: Blockchain Technology; Digital Currency; Cross-Border Payments; Ripple

1. Introduction

1.1 Background of the Study

Against the backdrop of deepening global economic integration, cross-border payments-serving as a critical component of international trade, transnational financial settlements, and capital flows-play a pivotal role in ensuring the stability and operational efficiency of the global financial system. However, traditional cross-border payment systems, such as SWIFT, though long-established and widely adopted, suffer from

inherent structural limitations, including prolonged settlement cycles, high transaction fees, complex operational procedures, and limited transparency. These shortcomings hinder their ability to meet the growing demand for real-time, low-cost, and highly traceable payments in the digital age.

The emergence of blockchain technology has created new opportunities for restructuring the cross-border payment system. Its core technical features-including decentralization, immutability, and programmability-have the potential to eliminate the reliance of traditional payment networks on financial intermediaries, thereby enabling the secure and rapid transfer of funds on a global scale. In particular, the integration of blockchain with digital assets holds the promise of facilitating efficient value transfer without the need for traditional trust-based relationships, offering a novel technological foundation for the evolution of global payment infrastructure.

Ripple, as a leading project in the field of blockchain-based cross-border payments, is dedicated to providing enterprise-level payment and settlement solutions for global financial institutions. Its payment network, built upon the XRP Ledger (XRPL), enables cross-border fund clearing within seconds while significantly reducing transaction costs and operational risks. Unlike public blockchain projects such as Bitcoin and Ethereum, Ripple is specifically designed to serve banks and payment service providers. Its technical architecture emphasizes compliance and scalability, making it more compatible with existing financial infrastructures. A representative real-world application is Santander Bank's "One Pay FX" initiative, which has successfully enabled real-time cross-border transfers across multiple countries since its launch in 2018. This deployment has notably enhanced both payment efficiency and user satisfaction.

1.2 Synthesis of Research

Current Status of Blockchain Application in Cross-Border Payment of Digital Currencies

Blockchain Technology Features and Cross-Border Payment Adaptability

Blockchain technology's features of decentralization, non-tampering and traceability provide an innovative solution to the traditional cross-border payment problem. Du Hongzhen (2023) [1] showed that blockchain realizes peer-to-peer value transfer through distributed ledger technology and significantly reduces intermediary costs. Its consensus mechanism ensures that transaction records cannot be modified without node verification, effectively solving the trust problem in cross-border payments. Lu & Ge Xinfeng (2018) [2] further point out that the traceability of blockchain allows the whole process of transaction to be completely recorded and tracked, improving transparency and providing effective monitoring means for regulation. The introduction of smart contracts, on the other hand, automatically enforces payment conditions and rules, reducing manual intervention and operational risks. Together, these features address the pain points of traditional cross-border payments, such as long settlement cycles (3-5 business days), high handling fees (1-3%) and opaque information.

Comparison of major models for cross-border payments in digital currencies

The current digital currency cross-border payment mainly presents three modes: traditional SWIFT system, private digital currency and central bank digital currency (CBDC). Chen Weiguang and Ming Yuanpeng (2023) [3] analyzed that, although the SWIFT system realizes global inter-bank information transmission through standardized messages, there is a risk of centralization, as shown by the incident of exclusion of some banks in Russia in 2022, and it has the inherent defects of low settlement efficiency and high cost.

Kodak (2021) [4] shows that while cryptocurrencies such as Bitcoin enable decentralized cross-border transfers, their sharp price volatility (more than 80% annual volatility) restricts their payment function. Stabilized coins, while partially solving the volatility problem, still face regulatory uncertainty and issuer credit risk. Ming Zhang et al. (2024) [5] point out that projects such as Libra Coin attempted to break through national boundaries but failed due to regulatory barriers, suggesting that private

digital currencies still face significant challenges in cross-border payments.

In contrast, the central bank digital currency (CBDC) combines the stability of fiat currency and the advantages of digital currency technology. Analysis by Ming Zhang et al. (2024) [5] shows that the digital RMB adopts a two-tier "central bank-commercial bank" operating system, which maintains the effectiveness of monetary policy while protecting privacy through a controlled anonymity design, and that the CBDC can realize real-time settlement, significantly reduce transaction costs, and at the same time avoid the market and trust risks of private digital currencies.

Practical Exploration of Cross-border Application of Central Bank Digital Currency

Central banks are actively exploring the cross-border application of digital currencies, and China's digital RMB (e-CNY) is in a leading position. Li Zhipeng et al. (year not specified) [6] point out that the design of e-CNY, which is "centralized in issuance management and decentralized in technical architecture", can achieve efficient cross-border payment function while maintaining the effectiveness of monetary policy. China has carried out cross-border payment pilots with Hong Kong, Thailand and the United Arab Emirates to verify the technical feasibility.

Qian Qiao (2022) [7] focuses on the analysis of the "Multi-Central Bank Digital Currency Bridge" (m-CBDC Bridge) project, which realizes the interconnection and interoperability of different CBDC systems through distributed ledger technology. Practical data show that this "wholesale" model can shorten the settlement time from days to seconds and reduce the cost by more than 50%. This model is expected to break the cross-border payment pattern dominated by SWIFT.

Challenges and Countermeasures for Blockchain Cross-Border Payments

Barriers at the technical realization level

The technical bottleneck of blockchain technology in cross-border payment application is mainly reflected in the two aspects of system interoperability and transaction processing capacity. Lu and Ge Xinfeng (2018) [2] found that the current blockchain network is generally characterized by the "silo effect" and the lack of unified standards and protocols among different systems, which leads to the inefficiency of capital flow in cross-border payment scenarios.

Zhu Qiaoling and Zhang Kun (2024) [8] further pointed out that the transaction confirmation time of mainstream public chains such as the Bitcoin network is as long as 10 minutes, and the transaction processing volume per second (TPS) is only about 7 transactions, which is far lower than the processing capacity of traditional payment systems.

In addition, the special characteristics of cross-border payments put forward higher requirements for blockchain systems. Lu & Ge Xinfeng (2018) [2] emphasize that the existing smart contract platforms are still insufficient in supporting the necessary functions of cross-border payment such as multi-currency exchange and compliance checking, and the lack of mature business logic abstraction and standardized interfaces increases the complexity of technical implementation.

Regulatory and Legal Compliance Challenges

The main regulatory challenges faced by blockchain cross-border payments are centered on both jurisdictional conflicts and anti-money laundering compliance. Kodak (2021) [4] analyzes that the cross-border nature of blockchain contradicts the sovereign state-based financial regulatory system, and that different determinations of the legal attributes of digital currencies across countries lead to regulatory arbitrage and enforcement difficulties.

A study by Chen, Weiguang & Ming, Yuanpeng (2021) [9] reveals new types of risks posed by digital currencies such as stablecoins, where the pseudo-anonymity feature of blockchain increases the difficulty of counterparty identification (KYC). Meanwhile, significant differences in regulatory policies across countries create a state of regulatory fragmentation, increasing compliance costs and legal risks for cross-border payment service providers.

Risks of reconfiguration of the international monetary system

The development of blockchain cross-border payments is reshaping the international monetary competition. Chen, Weiguang and Ming, Yuanpeng (2023) [3] illustrate the case of the "weaponization" of the SWIFT system, where the blockchain-based cross-border payment scheme of the Central Bank Digital Currency (CBDC) may weaken the dominant system of the U.S. dollar. Zhang Ming et al. (2024) [5] point out that the rise of digital currencies has exacerbated the currency substitution effect,

which may lead to the phenomenon of "digital dollarization" in countries with weaker economic fundamentals.

From a geopolitical perspective, the behavior of major economies actively laying out CBDC cross-border payment networks is not only a technological competition, but also a competition for monetary sovereignty and financial discourse. This competition, in the context of strategic competition between China and the United States, may exacerbate the risk of fragmentation of the international monetary system [3][5].

Future Directions and Research Recommendations

Technology integration and standardization

The integration of blockchain technology and financial infrastructure urgently requires the establishment of a standardization framework. Zhu, Qiaoling and Zhang, Kun (2024) [8] point out that technical barriers to cross-border payments mainly stem from the lack of interoperability between systems, and suggest that CBDC compatibility should be improved through industry standards. Qian (2022) [7] shows that the "wholesale" multilateral central bank digital currency bridge model requires a unified technical protocol, which requires central banks to reach a consensus on the distributed ledger architecture and cryptographic algorithms.

The implementation path should be advanced in phases: firstly, realize the docking between RTGS system and blockchain network, secondly, establish cross-chain interoperability protocols to solve the heterogeneous chain data exchange, and finally, form an internationally common distributed financial standard. China should actively participate in the BIS-led Multilateral Digital Currency Bridge Project to promote the establishment of a technical standard system that balances efficiency and security [7].

Construction of governance mechanisms for international cooperation

The governance of cross-border digital currency payments requires the establishment of a multilateral coordination mechanism. Chen Weiguang and Ming Yuanpeng (2021) [9] suggest that the current governance dilemma is reflected in the lack of clarity of the main body and the content, and suggest that a synergistic framework should be constructed from the three dimensions of market coordination, scientific and technological governance, and risk

regulation. Zhu Qiaoling and Zhang Kun (2024) [8] add that CBDC cross-border circulation involves the issue of monetary sovereignty, which needs to be resolved through international cooperation to solve the legal and regulatory barriers.

Specific programs should include: the establishment of an international digital currency regulatory forum, the development of AML/CFT joint regulatory standards; the establishment of a multilateral risk early warning mechanism to share monitoring data; and the construction of a cross-border payment dispute resolution platform. The governance mechanism should adhere to the principle of "technology neutrality" to avoid the formation of a new financial hegemony [9].

Strategic Opportunities for RMB Internationalization

Digital RMB provides a new opportunity for RMB internationalization. Li Zhipeng et al. (n.d.) [6] point out that the E-CNY's "two-tier operation" model combines the advantages of currency sovereignty and cross-border application. Qian (2022) [7] found that digital RMB has the potential to improve the international payment ecosystem in cross-border scenarios.

The path of promotion can be divided into three stages: first, a pilot retail-type cross-border payment; then wholesale clearing through a multilateral central bank digital currency bridge; and finally, the establishment of an international currency corridor centered on the digital RMB. Utilizing its programmable features to develop smart contract applications such as cross-border trade finance can enhance the stickiness of RMB's international use [6].

1.3 Research Objectives and Issues

While existing research largely focuses on the broad applicability of blockchain technology and the widespread adoption of digital currencies, relatively few studies have examined the Ripple protocol as a specific blockchain application and its distinctive role in cross-border payments. This study aims to analyze the implementation of Ripple in cross-border payment scenarios, investigate its technical features and comparative advantages, and evaluate its performance and potential in real-world markets. It further explores how Ripple can enhance the efficiency and security of cross-border transactions, the competitive edge it holds over traditional

payment systems, and the opportunities and challenges associated with its global adoption.

2. Research Methodology

2.1 Literature Analysis Method

The theoretical foundation and analytical framework of the paper are constructed by combing and summarizing the research results of domestic and foreign scholars in the related fields of blockchain technology, digital currency, cross-border payment system and Ripple application.

2.2 Case study Method

This paper selects Ripple as the application of blockchain payment method in actual cross-border payment scenarios, and analyzes its performance in terms of user experience, arrival time, transaction cost, security and other aspects. Through the case, it can intuitively reflect the landing path of blockchain technology in actual financial business and the transformative impact it brings.

2.3 Comparative Analysis

In order to show the technical characteristics and application effectiveness of Ripple more clearly, this paper will compare and analyze it with traditional cross-border payment systems. The comparison dimensions mainly include: transfer time, settlement cost, security performance, compliance ability and other aspects. Through comparison, it reveals the specific advantages and realistic limitations of blockchain technology in solving traditional cross-border payment pain points.

3. Findings of the Study

3.1 Analysis of the Ripple Cross-Border Payment Technology Mechanism

Ripple is a decentralized payment clearing platform for financial institutions, and its core function is to realize instant fund transfer and settlement on a global scale. Its technical mechanism is mainly reflected in the following aspects:

(1) XRPL-Decentralized Distributed Ledger (Core Foundation)

No need to rely on centralized institutions to verify transactions: unique consensus verification mechanism (RPCA), node consensus to ensure security, non-PoS/PoW

(2) XRP-Native Digital Currency (Bridge Currency)

XRP, as the native token of the Ripple network, can be used as a liquidity bridge between different fiat currencies, avoiding the need to set up a Vostro system in traditional cross-currency payments and greatly simplifying the structure and cost of cross-border payments.

(3) RippleNet-decentralized payment network

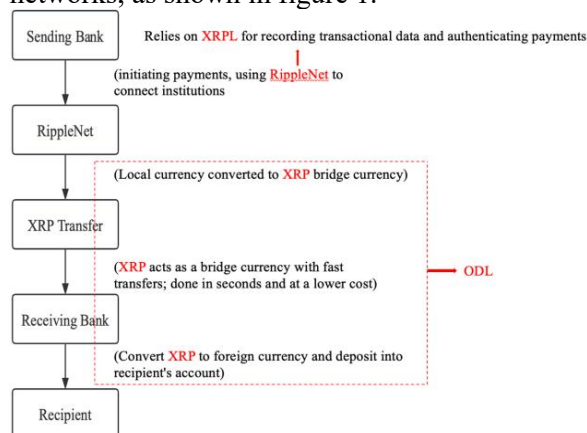
RippleNet is an enterprise-level blockchain payment network built by Ripple, providing a unified interface for global financial institutions to realize the simultaneous completion of messaging and fund settlement for cross-border payments. Unlike the traditional SWIFT network that only does messaging, RippleNet has end-to-end payment capabilities.

(4) ODL (On-Demand Liquidity)-Liquidity Services

Optimize liquidity, avoid capital consumption and exchange rate risk by using XRP as a bridge currency

(5) ILP (Interledger Protocol) interoperability protocols

Ripple's support for multi-chain interoperability protocols gives its system strong cross-system compatibility, making it easy to connect with traditional banking systems or other blockchain networks, as shown in figure 1.



**Figure 1. The Ripple Payment Process
Utilizing XRP as a Bridge Currency**

3.2 Competitive Advantages of Ripple Payments over Traditional Payments

In the current international cross-border payment system, the traditional infrastructure primarily relies on the SWIFT communication network and the Nostro/Vostro account mechanism. SWIFT (Society for Worldwide Interbank Financial Telecommunication), as the dominant

global interbank messaging system, is responsible for transmitting payment instructions. Actual cross-border fund clearing and settlement are carried out through the maintenance of Nostro and Vostro accounts between correspondent banks. Specifically, a Vostro account refers to a local currency account held by a foreign bank at a domestic bank, used for receiving, storing, or disbursing funds in the local currency on behalf of the foreign institution.

Payment information is transmitted via SWIFT messages, while the actual fund transfer is executed through the balances held in Vostro accounts. However, this system suffers from several major shortcomings related to efficiency, cost, and transparency. First, cross-border transactions typically involve multiple intermediary banks, resulting in extended transaction chains and settlement times, with fund transfers often taking 1 to 3 business days to complete. Second, Nostro/Vostro accounts require pre-funding, which ties up substantial liquidity and increases operational costs for banks. Furthermore, the disconnection between the flow of information and the movement of funds leads to a lack of real-time visibility, making the system susceptible to information mismatches, reconciliation challenges, and operational inefficiencies.

In contrast to the traditional SWIFT-based model, Ripple's blockchain-based cross-border payment system offers a decentralized and real-time alternative for clearing and settlement. RippleNet replaces the fragmented SWIFT messaging framework with a unified communication interface and leverages distributed ledger technology to establish an end-to-end, transparent settlement channel, as shown in figure 2.

The core innovation of Ripple lies in its On-Demand Liquidity (ODL) mechanism, which eliminates the need for pre-funded Nostro/Vostro accounts in foreign banks. Instead, the process is completed within seconds by converting the sender's fiat currency into XRP-the bridge currency-executing the transfer on-chain, and then converting XRP into the recipient's fiat currency. This real-time settlement framework significantly improves liquidity efficiency, reduces capital lock-up, and enhances transaction speed and transparency, as shown in table 1.

Traditional vs. Ripple

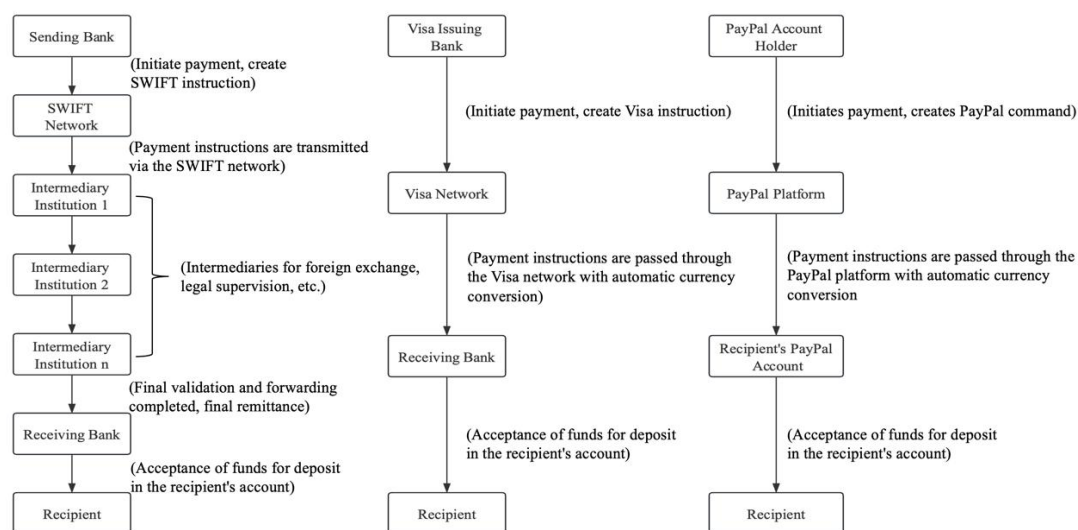


Figure 2. A Comparative Analysis of Traditional Payment Methods (SWIFT, Visa, PayPal) and the Ripple Payment Process

Table 1. A Comparative Analysis of Transaction Characteristics: Traditional Payment Methods (SWIFT, Visa, PayPal) vs. Ripple-Based Payments

	SWIFT	Visa	PayPal	Ripple
Transaction speed	1–5 working days	Hours to days	Minutes to hours.	seconds
transaction cost	Transaction costs: Originator bank charges:\$10–\$50	Transaction fee (issuer):1%-3% + fixed fee (according to issuer's policy)	Transaction fee:4.4% + fixed fee (depending on region)	Transaction costs: a few cents
	Agency fee: to be determined by the agency Recipient bank charges:\$10–\$20	Foreign exchange conversion fees: exchange rate premium 1–2%	Foreign exchange conversion fees: exchange rate premium 2.5%-4%	Foreign exchange conversion fees: no additional exchange rate differentials
	Foreign exchange conversion fees: exchange rate premium 1%-3%			
Transparency and security	Transparency: low (transaction costs and financial flows are not fully transparent)	Transparency: medium (payment process is traceable, but costs and data are not fully transparent)	Transparency: low (payment process not fully publicized)	Transparency: High (all transaction records are traceable and non-erasable on the blockchain)
	Security: High (SWIFT security is dependent on the intermediary bank)	Security: High (Visa guarantees payment security)	Security: High (PayPal guarantees payment security)	Security: High (guaranteed by RPCA consensus mechanism)

RippleNet eliminates the need for multiple intermediary banking layers inherent in traditional cross-border payment systems, thereby significantly enhancing transaction efficiency and reducing processing fees. In terms of liquidity management, the platform enables instant currency exchange, removing the necessity for large pre-funded accounts and effectively addressing the issue of liquidity fragmentation present in conventional systems.

Moreover, with all transaction paths recorded and traceable in real time on the blockchain, RippleNet enhances transparency, auditability, and regulatory compliance.

Several organizations have already partnered with Ripple and adopted its payment solutions, demonstrating significant improvements in transaction efficiency and cost reduction. For instance, SCB processed over 500,000 transactions on RippleNet in 2020 alone,

marking a 335% year-on-year increase. Instarem reduced its transaction time by 50%, while SBI Remit's settlement payments were completed in just 3 seconds. Nium reported a dramatic increase in the total volume of remittances and a 98% reduction in transfer fees within five months of using Ripple. Modulr also saw payments processed in under 10 seconds after integration, and Sentbe saved approximately \$25 million in foreign exchange and transaction fees, with remittance arrival times reduced to around 5 minutes. Additionally, MoneyMatch reduced its cross-border payment operating costs by 40%.

In summary, Ripple has developed a highly efficient, scalable, and transparent cross-border payment system by restructuring the communication, settlement, and liquidity management mechanisms. This innovative approach demonstrates substantial potential to substitute the traditional SWIFT + Nostro/Vostro account model, offering a transformative solution for the current payment infrastructure. Furthermore, Ripple provides new perspectives and methodologies for the future evolution of the global cross-border payment system.

3.3 Challenges and Opportunities for the Roll-Out of Ripple in the Global Marketplace

3.3.1 Challenges to replication

Although Ripple has made a name for itself in the global payments market with its efficient, low-cost cross-border payment capabilities, its large-scale rollout still faces multiple challenges: (1) Industry trust issues: acceptance of emerging technologies takes time

As a blockchain-based financial infrastructure, Ripple's underlying framework fundamentally diverges from that of traditional banking systems. Despite its potential, many financial institutions remain hesitant to adopt Ripple, primarily due to concerns regarding the stability, security, and long-term viability of this emerging technology. Additionally, the price volatility of XRP, the liquidity bridging asset within the Ripple network, coupled with its reliance on the crypto-asset market, has led some conservative financial institutions to exercise caution.

This concern is reinforced by recent market data: in Q1 2025, XRP experienced significant price movements, rallying to nearly \$3.40-its highest level since January 2018. Although the quarter began with a period of relative stability, realized volatility initially dropped from approximately

150% to 100%, only to spike back to 130% in February, where it remained through the end of the quarter. Such persistent and elevated volatility increases the perceived financial risk of utilizing XRP as a bridge currency, particularly for institutions that prioritize predictable settlement values.

Consequently, Ripple will require additional time and a more extensive track record to garner widespread industry trust.

(2) Legal and regulatory barriers: the need to address policies and regulations in different countries

The global promotion of Ripple faces significant challenges due to the varying legal and regulatory requirements across countries in the areas of cryptocurrencies, blockchain technology, and cross-border payments. For instance, the U.S. Securities and Exchange Commission (SEC) has filed a lawsuit against Ripple Labs, classifying XRP as a security, which has hindered its expansion in the U.S. market. In contrast, the regulatory landscape in regions such as Europe and Southeast Asia is more accommodating, facilitating Ripple's entry into certain markets. These disparities in regulatory frameworks necessitate Ripple's adoption of complex compliance adjustments and localization strategies, thereby increasing both the difficulty and cost of market penetration, as shown in figure 3.

(3) Market competition pressure: SWIFT GPI, Visa B2B Connect, PayPal Xoom and other traditional giants accelerate transformation

Although Ripple offers notable advantages in terms of cross-border payment efficiency and cost control, it faces significant competition from established industry giants. SWIFT GPI, an innovative global payment service introduced by SWIFT, leverages the existing banking network and data infrastructure to enhance payment transparency and speed, gaining the support of over 4,000 banks. Visa B2B Connect consolidates global corporate payment resources to offer secure cross-border transactions between enterprises. Xoom, a subsidiary of PayPal, specializes in retail remittance services, attracting a broad market base with its strong user appeal. These traditional platforms possess inherent advantages in customer loyalty, regulatory compliance, and channel integration, presenting substantial competitive pressure for Ripple, as shown in table 2.

Other Blockchain Solutions vs. Ripple Solutions

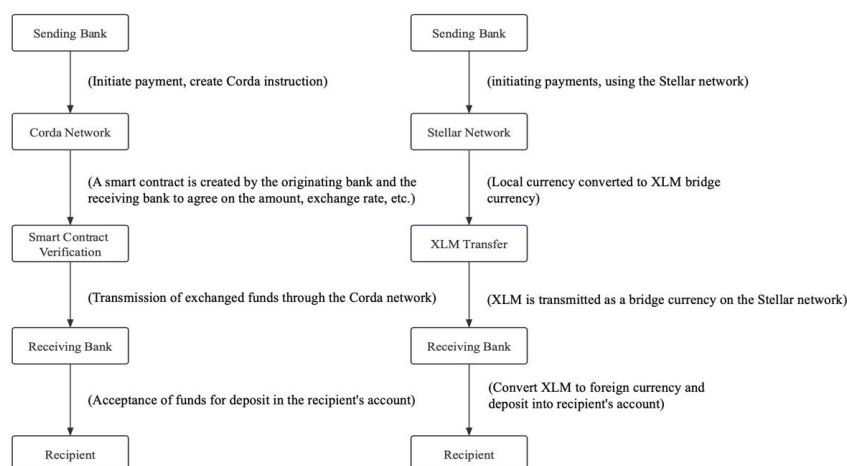


Figure 3. A Comparative Analysis of Other Blockchain-Based Payment Solutions (Corda, Stellar) and the Ripple Payment Process

Table 2. A Comparative Analysis of Transaction Characteristics: Other Blockchain Solutions (Corda, Stellar) vs. Ripple-Based Payments

	Corda	Stellar	Ripple
Transaction speed	Minutes to hours.	seconds	seconds
transaction cost	Higher (institutional involvement in smart contract setting)	low	low
Transparency and security	Transparency: low (privacy protection, transaction information visible only to relevant parties) Security: high (guaranteed by the "notary public" mechanism)	Transparency: High (all transaction records are traceable and non-tamperable on the blockchain) Security: High (guaranteed by SCP consensus mechanism)	Transparency: High (all transaction records are traceable and non-tamperable on the blockchain) Security: High (guaranteed by RPCA consensus mechanism)
degree of decentralization	low decentralization Relying on authorized licensed nodes (few trusted institutions)	Fully decentralized	Partial decentralization Authentication nodes that rely on authenticated (any accredited participant)
application scenario	Large-value payments between financial institutions, with a focus on privacy and compliance, in line with KYC/AML and other compliance requirements	Micropayments for cross-border e-commerce and personal payments	Interbank large-value payments, cross-border payments and inter-financial institution flows

3.3.2 Opportunities and prospects for replication
Despite the challenges, Ripple's global rollout is also facing many favorable factors, which provide a broad space for its future development: (1) Significant potential for integration with Central Bank Digital Currency (CBDC)

Currently, numerous countries worldwide have initiated or planned research and pilot programs for Central Bank Digital Currencies (CBDCs), marking the onset of the sovereign digital currency era. In this context, Ripple introduces a technology platform designed to support the issuance of CBDCs, as well as cross-border transfers and settlements, combining the benefits

of regulatory transparency with payment decentralization. Ripple Labs' CBDC platform, scheduled for release in 2023, will enable central banks to issue their own CBDCs on private chains, while utilizing XRP to facilitate cross-border clearing. This model is expected to dismantle clearing barriers between countries, strike a balance between regulatory compliance and technical efficiency, and potentially become the cornerstone infrastructure for the global digital currency payment system.

(2) Global e-commerce and digital economy development drive surging demand for cross-border payments

With the rise of global e-commerce, the freelance economy, and digital service trade, there is an increasing demand from businesses and individuals for cross-border payments that are "fast, cost-efficient, and highly transparent." Traditional payment systems are often characterized by high fees, slow processing times, and a lack of real-time information feedback, which makes them ill-suited to the liquidity needs of modern internet business models. Ripple's xRapid (On-Demand Liquidity, ODL) technology and its XRP bridge payment mechanism effectively address the needs of small-scale, high-frequency cross-border transactions. This is particularly advantageous for platform e-commerce, cross-border freelancer payments, and supply chain fund transfers.

In summary, Ripple must navigate several challenges, including technology adoption, regulatory compliance, and competitive pressures, as it expands globally. However, it also presents significant growth potential, particularly in its ability to cooperate with Central Bank Digital Currencies (CBDCs) and adapt to the trends of the global digital economy. Looking ahead, if Ripple continues to strengthen its partnerships with governments, financial institutions, and large enterprises while enhancing market transparency and compliance, it is well-positioned to capture a larger share of the evolving global payment system.

4. Discussion

4.1 Ripple's Inspiration to the Construction of China's Blockchain Cross-Border Payment System

4.1.1 Building a unified cross-border payment chain network platform

RippleNet provides a de-intermediated and interconnected global clearing network model, indicating that cross-border payment networks should no longer rely on multiple layers of intermediaries. China can promote the construction of an international settlement platform for digital currencies on the basis of the central bank's digital currency (e-CNY) and break the traditional clearing structure.

4.1.2 Enhancing mechanisms for bridging digital currencies and on-chain assets

Ripple solved the problem of currency exchange and liquidity by using XRP as a bridge asset. China can explore the construction of a

multi-currency cross-chain settlement mechanism of "digital RMB + anchored assets" to improve the efficiency of capital flow.

4.1.3 Promoting the integration of regulatory technology (RegTech)

Although the Ripple network is efficient, there are still challenges in compliance. China can introduce on-chain KYC/AML mechanism and smart contract risk control model under the leadership of the central bank to ensure cross-border payment security and regulatory control.

4.1.4 Developing the ecology of the "Belt and Road" financial chain

Drawing on Ripple's idea of building a multilateral payment network, China can establish a payment mutual recognition, digital currency settlement and trade clearing platform for countries along the Belt and Road based on e-CNY and blockchain, so as to enhance the internationalization level of RMB.

4.2 Suggestions on Feasible Paths for Building a Blockchain Cross-Border Payment System in China

At the policy level, it is essential to clarify the regulatory framework for the cross-border application of digital currencies, while encouraging conditional pilot projects for early-stage implementation, with gradual expansion to additional countries. At the technical level, efforts should be made to promote the construction of cross-border payment infrastructures based on blockchain and alliance-chain architectures, ensuring the security, controllability, and interoperability of the system, as well as supporting the settlement of RMB and multi-currency transactions. At the institutional level, a cooperation model led by the central bank should be introduced, incorporating commercial banks and supported by technology enterprises, to establish a robust industrial ecosystem for cross-border digital currency payments. Finally, at the international cooperation level, leveraging Ripple's experience in partnering with global banks, it is crucial to foster collaboration between China's digital currency payment platforms and large international organizations.

5. Conclusion

Taking Ripple as a representative case, this paper systematically explores the application model, technical mechanism, competitive

advantages, and global expansion strategy of blockchain technology in the field of cross-border digital currency payments. Through a combination of literature review, case analysis, and comparative study, the paper comprehensively examines the structural drawbacks of the current traditional cross-border payment systems and provides an in-depth evaluation of the technical potential and practical effectiveness of the Ripple network. Specifically, it assesses Ripple's impact on improving payment efficiency, reducing transaction costs, and enhancing system transparency.

It has been found that Ripple, through its distributed ledger structure and XRP bridge currency mechanism, establishes a decentralized cross-border payment system that integrates communication, clearing, and liquidity services. This significantly addresses the issues of low efficiency, high costs, and poor transparency inherent in the traditional SWIFT+Nostro/Vostro model. At the practical application level, case studies of financial institutions such as Santander Bank, SCB, and Nium further validate Ripple's significant advantages in improving transaction speed, reducing the need for pre-deposited funds, and enhancing the visibility of fund flows. However, Ripple's global expansion still faces challenges, including limited technological acceptance, regulatory compliance barriers, and increased market competition. Particularly in the context of the unclear legal status of XRP tokens and differing global regulatory frameworks, Ripple's development path requires continuous exploration and optimization.

In terms of outlook, with the accelerated development of global CBDC initiatives and the ongoing expansion of the digital economy, Ripple, as a technological platform for cross-border payment infrastructure, is positioned with significant potential for future growth. This is largely due to its capacity for

integration with central bank digital currencies (CBDCs) and its suitability for the payment needs of e-commerce and the freelance economy.

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