

Application Status and Challenges of Blockchain Technology in Cross-Border Payment in Hong Kong: Comparative Analysis Based on Cases of SWIFT and Local Banks

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ABSTRACT

As an international financial center, Hong Kong, China has a strong demand for cross-border payment. Although SWIFT, the current mainstream payment system, has the advantages of simple operation and safe process, it still has problems such as low settlement efficiency and high cost. The launch of SWIFT GPI has improved these problems to a certain extent, and blockchain technology has brought new possibilities for cross-border payment by virtue of its decentralized features. Through theoretical and empirical comparison, this study analyzes the "efficiency-cost-risk" performance of traditional SWIFT, SWIFT GPI and blockchain technology in cross-border payment in Hong Kong, China and discusses the feasibility of blockchain replacement based on the "technology-regulation-society" dimension. Theoretically, blockchain has obvious advantages in efficiency (near real-time delivery) and cost (significantly lower than SWIFT), but there are technical, regulatory, privacy and other risks. The efficiency and cost of SWIFT GPI are better than those of traditional SWIFT, but still inferior to blockchain. Taking Hong Kong, China HSBC as an example, the same transaction conditions are selected to compare the three: the total cost of traditional SWIFT is 850.88HKD, and the time limit is 2-5 working days; The total cost of SWIFT GPI is 450.34HKD, and the time limit is 1-3 hours. The total cost of the blockchain-based mBridge project is less than 0.78HKD, and the time limit is 6-9 seconds, which further confirms the theoretical analysis. The study found that the application of blockchain in cross-border payment in Hong Kong, China faces challenges such as technology (throughput limitation, difficult to upgrade and maintain), policy (conflict with privacy regulations, cross-border regulatory differences), and market (low acceptance). Based on this, some suggestions are put forward, such as "blockchain +SWIFT" hybrid architecture, revision of relevant regulations, establishment of innovation special zone, etc., to provide reference for improving cross-border payment system and developing fintech in Hong Kong, China.

KEYWORDS

Blockchain; Cross-border payment; SWIFT

1 Introduction

As an important global trade hub, Hong Kong, China has a strong demand for cross-border payment. The efficiency, cost and security of its payment system will directly affect the regional economic development of Hong Kong, China. At present, SWIFT is the mainstream cross-border payment system in Hong Kong, China. As a global financial communication platform, SWIFT is mainly responsible for inter-bank payment, information exchange and fund transfer. Traditional SWIFT has the advantages of simple operation and secure process, but it still has the pain points of low settlement efficiency and high cost. To address the many pain points of traditional cross-border Payments, SWIFT launched the SWIFT GPI (Global Payments Innovation) in 2017, aiming to meet customers' needs by improving cross-border payment efficiency, transparency and reducing costs, and help banks adapt to the rapidly changing payment environment. At the same time, local banks in Hong Kong, China have participated in several cross-border payment projects based on blockchain technology, actively developed fintech, and optimized and improved Hong Kong, China's cross-border payment system. However, the coexistence of traditional SWIFT, SWIFT GPI and blockchain technology raises key questions: How do these systems compare in terms of actual performance? What barriers limit blockchain adoption at scale? This study will compare traditional SWIFT, SWIFT GPI (unless otherwise specified, "SWIFT" hereafter is the general term of traditional SWIFT and SWIFT GPI) and blockchain technology at the theoretical level. At the empirical level, it will select the case of HSBC in Hong Kong, China to analyze the advantages and disadvantages of the three technologies around "efficiency, cost and risk". According to the "technology-regulation-society", the feasibility of blockchain technology replacement is analyzed. Through theoretical comparison and analysis, while revealing how blockchain technology improves payment efficiency and reduces cost, it can more clearly explain the impact mechanism of blockchain technology on cross-border payment efficiency and cost, and improve relevant theories; By analyzing the case of HSBC cross-border payment and settlement service, we can fill the gap of empirical research on the comparison between blockchain and SWIFT. In addition, the policy and regulatory conflicts found in this study will help Hong Kong, China improve its regulatory mechanism and provide experience for the development of fintech in Hong Kong, China.

2 Blockchain technology and its application in cross-border payments

Blockchain is a decentralized distributed ledger that combines chained data structures, P2P networks, consensus algorithms, cryptography and smart contracts. It is decentralized, immutable and traceable. The idea of blockchain can be traced back to the early 1990s. In 1991, Stuart Haber and Wakefield Scott Stornetta proposed the concept of

cryptographics-protected chain of records. In 2008, Satoshi Nakamoto established a mature model and application for blockchain technology. In 2009, the first bitcoin transaction was successful. With the launch of the first blockchain and cryptocurrency, the impact of blockchain on the technology industry began to be seen, with the most widespread application in the financial sector. In the international academic community, scholars have begun to study the application of blockchain technology in cross-border payments. Some studies have focused on the development of blockchain-based cross-border payment system models to enable faster and low-cost transaction processing. For example, Md. Mainul Islam (2023) proposed an alliance chain-based cross-border payment system to reduce transaction costs and enhance transparency by creating auditable cryptocurrencies. Some scholars, such as Eswar Prasad (2023), have analyzed the possible impact of digital currencies and blockchain technology on the international monetary system, arguing that they may reduce frictions in cross-border payments, but at the same time may increase the volatility of capital flows and exchange rates.

In China, research on the application of blockchain technology in cross-border payments has also been advancing. Qiu Tian-yi (2019) focused on the comparison between Ripple and SWIFT, two major cross-border payment systems, and discussed the potential and challenges of blockchain technology in cross-border payment. Fu et al. (2021) went a step further by building a smart cross-border transaction system and conducting a case study in Shenzhen, which provides a reference for the optimization of cross-border payment systems. Zhang et al. (2023) focused on the potential application of China's central bank digital currency (CBDC) in cross-border payment, and how to use blockchain technology to optimize accounts receivable financing in cross-border trade. Other studies have explored the innovative application model of blockchain in cross-border payments and analyzed the risks, including technical, legal and financial risks.

3 Theoretical comparison and analysis between SWIFT and blockchain technology in cross-border payment in Hong Kong, China

3.1 Efficiency comparison

The cross-border payment process of the traditional SWIFT system involves multiple intermediaries, resulting in a long settlement time, usually taking about 2-5 days, which is mainly due to the fact that the books between different banks need to be checked and confirmed one by one, and is affected by time zones, holidays and other factors. SWIFT GPI has improved significantly in terms of efficiency, reducing the settlement time to a few hours by optimizing the process and adopting new technical standards. According to HSBC, the use of SWIFT GPI for cross-border payments enables faster delivery and meets customers' higher demand for timeliness. The decentralized nature of blockchain technology and the distributed ledger structure make it possible that in cross-border payments, once the transaction information is confirmed, it will be updated to the ledger of all nodes simultaneously, without the cumbersome processing of multiple intermediaries, thus achieving near real-time arrival.

3.2 Cost comparison

The cost of the traditional SWIFT system is high, with the handling fee usually ranging from 1.0% to 3.0% of the transaction amount, which increases the burden on enterprises and individuals to make cross-border payments. The SWIFT GPI has improved in terms of cost control, with its fees dropping to 0.5%-1.5%. While this is a reduction compared to traditional SWIFT, it is still higher than the cost of using blockchain technology. The application of blockchain technology has significantly reduced the cost of cross-border payments. This is because blockchain technology reduces the involvement of intermediaries, reduces the fees of intermediate links, and simplifies the process, reducing the cost of manual operation and error handling.

3.3 Risk comparison

After long-term development, the traditional SWIFT system has formed a relatively perfect security mechanism and a relatively safe process. However, due to its centralized structure, there is a risk of single point of failure. SWIFT GPI inherits some of the advantages of traditional SWIFT in terms of risk control, and makes improvements in transparency, which improves the traceability of transaction status. However, due to its centralized architecture, there are still some systemic risks. Blockchain technology has the characteristics of immutability. It ensures the security and integrity of transactions through cryptography and consensus algorithms, and reduces the risk of fraud. However, blockchain technology also faces some new risks. For example, technical performance bottlenecks can lead to congestion during peak trading periods; Regulatory conflicts can lead to compliance risks; Lack of market acceptance may affect its wide application. In addition, by mining and analyzing blockchain transaction information, attackers may identify users' identities, transaction patterns and other sensitive information, which may lead to the risk of privacy leakage.

4 An empirical comparative analysis of SWIFT and blockchain technology in cross-border payment in

Hong Kong, China--HSBC

4.1 Background of case study

HSBC supports traditional SWIFT and SWIFT GPI, and participates in the mBridge project with blockchain as the underlying technology. Therefore, this study selects HSBC Hong Kong, China as the case of empirical analysis, combines the quantitative data such as transaction timeliness and cost, and the qualitative data such as policy, to compare and analyze the local blockchain project in Hong Kong, China and SWIFT. "HSBC Cross-border Wire Transfer Process (traditional SWIFT)" was used as control group 1, "HSBC Cross-border Wire transfer Process (SWIFT GPI)" was used as control group 2, and "HSBC Blockchain Settlement Service Case (mBridge)" was used as experimental group. At the same time combined with Hong Kong, China policy conflict with block chain technology, discuss the potential block chain technology, obstacles and challenges.

4.2 Cost structure

Empirical, cross-border payment cost consists of the dominant cost and recessive cost, explicit costs include: basic fee, the moving costs (SWIFT), telecom, receiving bank books cost; Implicit costs include bank exchange rate markup and capital cost in transit.

According to the policy of cross-border remittance using traditional SWIFT disclosed on the official website of HSBC, the handling fee of online bank remittance in the range of 50000HKD to 100000HKD is 0.125%; $\frac{78 + 390}{2} = 234\text{HKD}$ The deductible fee range is usually about 78-390HKD (10-50USD). It is estimated that the range of transfer fee in the 50000HKD scale is; SWIFT message transfer fee is usually fixed amount, reference for Shanghai pudong development bank case, such as HSBC telecommunications cost estimates for 100 HKD; $\frac{10 + 50}{2} = 30\text{HKD}$ The entry fee of mainland Chinese banks is 10-50HKD, which is estimated as; Take June 11, 2025 as an example, the market real-time exchange rate is 1HKD=0.9148CNY, HSBC may adopt the internal exchange rate of 0.5%-1% lower than the market, take the middle value of 0.75%, the exchange rate markup loss can be estimated to be 410HKD; $\frac{50000 \times 3\% \times 3.5}{365} \approx 14.38\text{HKD}$ It takes 2-5 working days for the remittance to arrive, with the median value of 3.5 days, calculated at an annualized interest rate of 3%, and the cost in transit is estimated as. In summary, the total cost of cross-border payments using traditional SWIFT is HKD 850.88 (1.7%). Similarly, the cost of obtaining users to make cross-border payments using SWIFT GPI is 70HKD, 100HKD for transferring banks, 30HKD for receiving banks, 250HKD for exchange rate markup loss, and 0.34HKD for funds in transit, with a total cost of 450.34HKD.

If blockchain technology is used for cross-border payment, the average cost and timeliness of the whole mBridge project are adopted because the information data of HSBC cross-border payment through mBridge is not found, which are: cost $\leq 0.78\text{HKD}$, timeliness 6-9 seconds respectively.

Table 1

HSBC Bank of Hong Kong, China	Traditional SWIFT	SWIFT GPI	mBridge
Cost	Explicit costs:	Explicit cost:	HKD 0.78 or less
	Handling fee 62.5HKD+	Handling fee 70HKD+	
	Transfer fee is 234HKD+	Transfer fee 100HKD+	
	Telecommunications charge 100HKD+	Receiving bank entry fee 20HKD	
	Collection bank entry fee 30HKD		
	Hidden costs:	Hidden costs:	
	Exchange rate markup of 410HKD+	Exchange rate markup of 250HKD+	
	The cost of funds in transit is 14.38HKD	The cost of capital in transit is 0.34HKD	
	Total cost: 850.88HKD (1.7%)	Total cost: HKD 450.34 (0.9%)	Total cost: 0.78HKD
Time limit	2-5 business days	1-3 hours	6-9 seconds

4.3 Conclusion

Compared with control group 1 and control group 2, the experimental group was optimized in both cost and timeliness. From the perspective of efficiency, the blockchain settlement service of HSBC has achieved near-real-time arrival to the account, which is a qualitative leap compared with the traditional SWIFT three days and SWIFT GPI several hours. This greatly meets customers' demand for rapid settlement in cross-border payments, accelerates capital turnover and improves the efficiency of capital use of enterprises.

In terms of cost, the handling fee of blockchain settlement service has been reduced to 0.5%-1%, which is significantly lower than the 1.0-3.0% of traditional SWIFT and 0.8%-1.5% of SWIFT gpi. The lower cost has made HSBC more competitive in the cross-border payment market, attracting more customers to use the service.

5 Challenges in the application of blockchain technology in cross-border payments in Hong Kong, China

5.1 Technical challenges

Throughput limitation is one of the major technical challenges faced by blockchain technology. Currently, most blockchain-based cross-border payment systems have limited processing capacity and cannot meet the large number of cross-border payment transactions in Hong Kong, China. During the peak period of transactions, the throughput limitation may lead to transaction congestion, delay and other problems, affecting transaction efficiency and user experience. In addition, it is also difficult to upgrade and maintain the technology of blockchain system, and the consensus and collaboration between different nodes takes a lot of time and resources.

5.2 Policy challenges

Hong Kong, China's Personal Data (Privacy) Ordinance aims to protect personal privacy data security. Article 26 of the Ordinance stipulates that individuals have the right to delete their data, which makes it in conflict with the immutability of blockchain. In blockchain systems, once transaction information is recorded, it cannot be deleted, leaving users to choose between efficient and low-cost payment methods and privacy protection. In addition, the regulatory policies of different countries and regions involved in cross-border payments are different, which may lead to the emergence of arbitrage opportunities while facing compliance risks.

5.3 Market challenges

Market acceptance is an inevitable challenge for every new technology, and the same is true for blockchain technology. In cross-border payment in Hong Kong, China, many enterprises and individuals have a shallow understanding of blockchain technology and have doubts about its security and reliability, so they prefer to choose traditional payment methods, such as the SWIFT system.

6 Suggestions

In terms of technology, the "blockchain +SWIFT" hybrid payment architecture is proposed: Blockchain processes high-frequency small payments, and SWIFT acts as a standby channel to process large transactions (since SWIFT GPI is superior to traditional SWIFT in terms of efficiency and cost, in the hybrid architecture, SWIFT GPI is preferred to process large transactions, and traditional SWIFT is used only when it is not available). This hybrid architecture can make full use of the respective advantages of blockchain and SWIFT to improve the overall efficiency and stability of cross-border payment systems.

In terms of regulation, it is proposed to amend the Personal Data (Privacy) Ordinance to accommodate blockchain features. On the premise of protecting personal privacy, special provisions can be formulated for the immutability of blockchain technology, and the way data can be stored, used and deleted in blockchain can be clarified. At the same time, a cross-department and cross-regional regulatory cooperation mechanism should be established to strengthen the supervision of cross-border blockchain payments and prevent financial risks.

Socially, a special zone for blockchain innovation technology will be set up to encourage banks and technology enterprises in the region to increase investment in the research and development of blockchain technology and improve the performance and security of blockchain technology; The government can provide subsidies, tax incentives and other measures to support the cost of technology development and promote the implementation of blockchain technology.

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