Integrating blockchain into global finance: a case study of SWIFT's strategic collaboration with Chainlink

Integração do blockchain no financeiro global: um estudo de caso da colaboração estratégica da SWIFT com a Chainlink

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Abstract
This study scrutinizes the strategic blueprint implemented by SWIFT in 2023, focusing on the integration of blockchain technology into the financial communication infrastructure. By conducting a systematic analysis, juxtaposed with current academic dialogues, the research reveals SWIFT's response to the emerging demands for secure, efficient, and collaborative financial transactions. The collaboration with Chainlink is highlighted as a practical move towards addressing the exigencies of enhanced cyber resilience and governance in the face of evolving technological landscapes. The study's findings illuminate the potential of SWIFT's approach to streamline the transition towards blockchain technology, minimizing the adaptation requirements for financial institutions, and suggesting a replicable model for widespread adoption. The relevance of this research extends beyond academic circles, offering insights into the adoption of blockchain technology at a critical juncture in financial history, with implications for improved transactional security and efficiency that benefit a broad spectrum of stakeholders. Regulatory bodies, financial entities, and consumers stand to gain from the advancements detailed in this study, which outlines a path for the integration of technology that promises a more cohesive, secure, and efficient global financial system. This research contributes to the literature by providing a nuanced understanding of blockchain's practical applications and sets the stage for future innovations in financial operations.

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Resumo
Este estudo analisa o plano estratégico implementado pela SWIFT em 2023, concentrando-se na integração da tecnologia blockchain na infraestrutura de comunicação financeira. Ao realizar uma análise sistemática, em contraste com os diálogos acadêmicos atuais, a pesquisa revela a resposta da SWIFT às demandas emergentes por transações financeiras seguras, eficientes e colaborativas. A colaboração com a Chainlink é destacada como uma medida prática para abordar as exigências de maior resiliência cibernética e governança diante de paisagens tecnológicas em evolução. As descobertas do estudo iluminam o potencial da abordagem da SWIFT para simplificar a transição para a tecnologia blockchain, minimizando os requisitos de adaptação para as instituições financeiras e sugerindo um modelo replicável para adoção em larga escala. A relevância desta pesquisa estende-se para além dos círculos acadêmicos, oferecendo insights sobre a adoção da tecnologia blockchain em um momento crítico da história financeira, com implicações para a melhoria da segurança e eficiência transacional que beneficiam um amplo espectro de partes interessadas. Órgãos reguladores, entidades financeiras e consumidores têm muito a ganhar com os avanços detalhados neste estudo, que traça um caminho para a integração de tecnologias que prometem um sistema financeiro global mais coeso, seguro e eficiente. Esta pesquisa contribui para a literatura ao fornecer uma compreensão matizada das aplicações práticas da blockchain e prepara o terreno para futuras inovações em operações financeiras.


Introduction

The purpose of this article is to analyze the impact of blockchain technology implementation, mediated by the collaboration between SWIFT and Chainlink, on the efficiency, security, and interoperability of international financial asset transfers.

The SWIFT network (Society for Worldwide Interbank Financial Telecommunication) is a crucial infrastructure for carrying out international monetary and security transfers. It functions as an extensive messaging network used by banks and other financial institutions to
execute transactions quickly, accurately, and securely. Founded in Brussels in 1973, SWIFT was created with the aim of establishing common processes and standards for financial transactions (Scott & Zachariadis, 2012).

The SWIFT network facilitates the global exchange of funds, being an essential element in global trade, as exclusion from this network can severely affect the ability of banks and even nations to engage in commerce (Scott & Zachariadis, 2012).

Blockchain technology has been explored and proposed to improve various aspects of the financial sector, including interaction with the SWIFT network, which is crucial for communication between financial institutions worldwide. A series of studies (Tennakoon & Gramoli, 2022; Dubey, Gunasekaran, Bryde, Dwivedi, & Papadopoulos, 2020; Qiu, Zhang, & Gao, 2019) discussed how blockchain can be integrated or used in conjunction with the SWIFT network to improve efficiency, trust, and security in global financial transactions.

According to Dubey et al. (2020), blockchain technology can enhance swift-trust, collaboration, and resilience within a humanitarian supply chain context, which may have implications for how the SWIFT network facilitates cooperation among financial institutions in humanitarian scenarios.

On the other hand, Qiu et al. (2019) contrast the Ripple system, based on blockchain, with the SWIFT system, exploring how blockchain can transform cross-border remittances by offering more efficient and secure processes. This study suggests that blockchain could provide viable alternatives to the traditional SWIFT infrastructure, especially in terms of international remittances.

Recently, Chainlink has been rapidly evolving as a decentralized platform for smart contracts. This format aims to connect smart contracts with real-world data, thus providing a bridge between blockchain systems and non-blockchain systems. As a blockchain Oracle, Chainlink enables smart contracts to interact with external data sources, payments, events, and other off-chain operations in a secure and verifiable way. Beniiche (2020) explores blockchain oracles, highlighting the crucial role they play in extending the functionality of smart contracts beyond the limits of the blockchain. Similarly, Al-Breiki et al. (2020) emphasize the importance of reliable oracles, comparing different solutions and identifying open research challenges in the domain of blockchain oracles. The study by these authors suggests a recognition of the vital role that platforms like Chainlink play in building a more functional and secure blockchain infrastructure, allowing for more complex and reliable interactions between blockchain and the external world.
In this sense, Chainlink, being a decentralized oracle, can facilitate interoperability between the SWIFT network and various blockchains. Through Chainlink's oracles, the SWIFT network could access external data securely and reliably, which is crucial for financial transactions that require verification and validation of information from multiple sources.

Considering these aspects, the question is how does the implementation of blockchain technology, through the collaboration between SWIFT and Chainlink, impact the efficiency, security, and interoperability in international financial asset transfers?

The methodology for exploring the impact will involve conducting a systematic literature review to assimilate the current state of blockchain technology, the operational configuration of SWIFT, and the nature of the collaboration between SWIFT and Chainlink. The collection and analysis of technical reports, academic publications, and official documents from SWIFT and Chainlink will be carried out. The analysis of the collected data was conducted by critical review observing the findings of SWIFT reports and the findings of academic literature.

The investigation into SWIFT's 2023 strategy unveils a pivotal development in integrating blockchain technology into the financial industry, highlighting key findings that resonate with the thrust of contemporary academic discourse. The strategic initiative of SWIFT to interlink its robust infrastructure with blockchain networks has pragmatically addressed crucial demands for tighter inter-institutional collaboration, advanced cyber resilience, and strengthened governance. This aligns with the sector's commitment to enhancing operational efficiencies and security, demonstrating an openness to multilateral partnerships, as evidenced by the collaboration with Chainlink. Furthermore, the experimental endeavors undertaken by SWIFT signal a forward-looking approach, simplifying the transition to blockchain technology with minimal disruption, thus setting a potential standard for broader adoption across the financial sector. These findings underscore SWIFT's role in leading financial innovation and suggest a model that promotes a swift and economically feasible integration of blockchain technology, which could have far-reaching implications for global financial operations.

The relevance of this study to the academic literature and its social significance in the current historical context is profound. As the global financial system grapples with the need for greater transparency, security, and efficiency, the integration of blockchain technology, exemplified by SWIFT's 2023 strategic initiative, offers a timely and pivotal contribution. This research not only enriches the scholarly discourse with empirical insights into the practical application of blockchain within established financial networks but also has the
potential to inform policy and operational frameworks across the sector. The beneficiaries of this research are manifold, encompassing regulatory bodies, financial institutions, and ultimately the consumers, who stand to gain from more secure, efficient, and cost-effective financial services. By charting a path for the harmonious integration of innovative technologies into the financial fabric, this study serves as a beacon for future research and implementation, marking a significant step towards a resilient and interconnected financial future.

**Theoretical**

**2.1 SWIFT-Net**

The SWIFT network is a global communication infrastructure that facilitates the secure, standardized, and reliable exchange of financial information among financial institutions (Scott & Zachariadis, 2012). This system has been vital for the efficiency and security of international financial asset transfers. However, with the evolution of technologies, especially blockchain, there is a continuous search to improve the efficiency, security, and interoperability of these transfers. The collaboration between SWIFT and Chainlink, employing blockchain technology, may be a promising avenue to achieve these objectives.

Fuster, De Hert, and Gutwirth (2008) discuss the vulnerability of transatlantic data transfers via SWIFT, pointing to a need to improve security and data protection in international financial transactions. The implementation of blockchain technology, known for its decentralized nature and cryptographic security, could address some of these vulnerabilities, providing an additional layer of security and transparency.

The theory of swift trust development discussed by Leung, Chang, Cheung, and Shi (2022) may be relevant to understanding how trust is built and maintained in real-time transfer systems. The collaboration between SWIFT and Chainlink can be seen as a means of transferring this trust to the efficiency, security, and interoperability of international financial asset transfers through the implementation of blockchain technology.

Lingl (1981) analyzes the allocation of risks in international interbank electronic fund transfers, specifically through CHIPS and SWIFT. This analysis can be expanded to consider how blockchain can mitigate risks and improve the allocation of responsibilities in international asset transfers.
In the near future, as discussed by Robinson, Dörry, and Derudder (2023), global networks of money and information may be at a crossroads, with the correspondent banking system and SWIFT playing crucial roles. The integration of blockchain technology, mediated by the collaboration between SWIFT and Chainlink, can be a strategic step toward improving the efficiency, security, and interoperability of international financial asset transfers.

Therefore, this body of literature suggests that the collaboration between SWIFT and Chainlink, and the consequent implementation of blockchain technology, may have a significant impact on improving efficiency, security, and interoperability in international financial asset transfers.

2.2 Blockchain Oracles: Chainlink

Three concepts are fundamental to understanding the potential of blockchain technology, especially when it comes to interactions with the external world through oracles like Chainlink. The combination of blockchain and oracles can potentiate a wide range of applications, including improving efficiency, security, and interoperability in international financial asset transfers, such as those facilitated by SWIFT.

Blockchain is a distributed ledger technology that allows for the creation of a shared, immutable, and verifiable ledger among different parties. Each block in the chain contains a number of transactions and is linked to the previous block through a cryptographic hash, thus creating a blockchain. Blockchain is known for its transparency, security, and immutability, making it a promising technology for various applications, including finance, supply chains, and identity management (Narayanan et al., 2016).

Within blockchain technology, the role of oracles is evident. Oracles are entities that facilitate communication between the external world and the blockchain, providing external data to smart contracts executed on blockchain networks, acting as bridges between the blockchain and the outside world, allowing smart contracts to access information that is not natively available on the blockchain, such as asset prices, weather conditions, or other data from external systems (Al-Breiki et al., 2020; Beniiche, 2020).

Specifically, Chainlink is a decentralized oracle network that allows smart contracts on the blockchain to connect with external data sources, APIs, and traditional payment systems. Through the use of oracles, Chainlink enables smart contracts to access information outside of the blockchain securely and reliably, which is crucial for many practical applications of blockchain technology. Chainlink is one of the most well-known and used
oracle networks, and has an architecture that allows for data aggregation from multiple oracles to increase the reliability and accuracy of the data provided to smart contracts (Breidenbach et al., 2021; Kaleem & Shi, 2021).

The decentralized and secure nature of blockchain, combined with the ability of Oracles to provide external data to smart contracts, may have significant implications for the efficiency, security, and interoperability in international financial asset transfers, especially when mediated by the collaboration between SWIFT and Chainlink.

Al-Breiki et al. (2020) offer a comprehensive review of blockchain Oracles, highlighting the need for reliability and security in providing external data to smart contracts on the blockchain. They discuss and compare different Oracles, including Chainlink, shedding light on the challenges and characteristics that make Oracles reliable and secure.

Beniiche (2020) provides a study on blockchain Oracles, which can be crucial for understanding how Chainlink can be utilized to improve efficiency and security in international financial asset transfers mediated by the SWIFT network.

Breidenbach et al. (2021) discuss the evolution of decentralized Oracles with a focus on Chainlink, pointing to the next steps in the evolution of decentralized Oracle networks. The findings of this work offer important insights into how the collaboration between SWIFT and Chainlink can evolve to meet the demands for efficiency, security, and interoperability in the context of international financial asset transfers.

In the work of Kaleem and Shi (2021), the use of Chainlink Oracles in Ethereum is demystified, providing a perspective on how Chainlink is utilized in practice, which may be relevant for understanding how the collaboration between SWIFT and Chainlink can be implemented to improve international financial asset transfers.

Breidenbach et al. (2021) and Bauer (2022) provide specific details about Chainlink's off-chain reporting protocol and an introduction to Chainlink, respectively, which can be fundamental to understanding the functionality and capabilities of Chainlink, especially in the context of collaboration with SWIFT.

These works collectively point to the potential of blockchain technology and Oracles like Chainlink, in collaboration with existing systems such as SWIFT, to improve efficiency, security, and interoperability in international financial asset transfers. The careful and well-designed integration of Chainlink with the SWIFT network may pave the way for faster, more secure, and transparent cross-border transactions, meeting the growing demands of an interconnected and resilient global financial system.
Methodology

The methodology of this study will encompass a systematic approach aimed at examining the implications of integrating blockchain technology, specifically through the collaborative efforts of SWIFT and Chainlink, on the efficiency, security, and interoperability of international financial asset transfers. This comprehensive analysis will be structured as follows:

3.1 Systematic Literature Review

A rigorous systematic literature review will be conducted to identify, select, and critically assess relevant academic articles, technical reports, and official documents. The search strategy will include a combination of keywords related to SWIFT, Chainlink, blockchain, international transfers, and financial technology. Databases such as Scopus, Web of Science, and Google Scholar will be utilized for the literature search. The inclusion criteria will be clearly defined to ensure the selection of literature that is pertinent to the objectives of this study. The literature review will synthesize findings to construct a coherent understanding of the current state of blockchain integration with SWIFT and the role of Chainlink oracles in this context.

3.2 Analysis Framework

An analytical framework will be established based on the concepts of efficiency, security, and interoperability. This framework will guide the examination of the collected literature, facilitating a focused analysis on how blockchain technology can influence these three critical areas of international financial asset transfers.

3.3 Data Collection

Data will be collected from various sources, including peer-reviewed journals, industry reports, and case studies. Special attention will be given to the documentation provided by SWIFT and Chainlink to understand the technical and operational nuances of their collaborative endeavors.
3.4 Data Analysis

The data analysis will involve a qualitative approach, using content analysis to identify themes and patterns within the literature. A critical review will be conducted to assess the benefits, challenges, and potential outcomes of adopting blockchain technology in the realm of international financial transactions, particularly through the lens of the SWIFT-Chainlink collaboration.

3.5 Triangulation

To ensure the validity and reliability of the findings, data triangulation will be employed. This will involve corroborating information from various sources and perspectives to form a comprehensive view of the subject matter.

3.6 Reporting

The results of the systematic literature review and data analysis will be documented in a structured format. The findings will be presented in a manner that aligns with academic standards, ensuring clarity, coherence, and a logical flow of information. The discussion will provide insights into the current landscape and future prospects of blockchain technology within the financial sector, especially regarding international asset transfers facilitated by SWIFT and Chainlink.

Results Analysis

4.1 Description of the Swift Experiment

As described in the SWIFT report (2023), the SWIFT platform outlined a strategy aiming to facilitate a secure and effective interconnection between financial institutions and blockchain networks, employing SWIFT's existing infrastructure. The goal was to broaden the industrial understanding of the technical and corporate requirements necessary for interaction with both public and permissioned blockchain networks.
The project was articulated in two distinct workflows: the initial phase focused on designing the technical solution, and the subsequent phase turned to non-technical aspects such as data privacy and governance. The technical aspect was fully simulated by SWIFT and Chainlink, aiming for the secure and effective transfer of asset tokens across various blockchain networks.

The experiment utilized Chainlink's Cross-Chain Interoperability Protocol (CCIP) to enable the transmission of tokens across blockchains. An experimental Software Development Kit (SDK) was developed by SWIFT with the purpose of minimizing the changes needed at the sending institutions, ensuring a smooth transition to blockchain infrastructure.

Throughout the experimentation, about 50 token transfers were conducted, with approximately 20 failure scenarios examined to validate the expectations of transfer failure. The proposed solution aimed to reduce the level of investment and adaptation required by financial institutions to instruct tokenized asset transfers, while maintaining the key roles and functions demanded by regulators.

The solution adopted CCIP as an abstraction layer to create blockchain transactions and securely transmit them to the Forwarder contract. The cross-chain transfer process was monitored by CCIP, which provided status updates to SWIFT, ensuring transparency, risk management, and transaction progress reports for all relevant parties.

To initiate the process of creating blockchain messages, it was crucial to collect a set of information in specific fields of the MT 543 Deliver Against Payment, with some new field options suggested to capture specific details of the blockchain.

The proposed methodology sought to optimize the current operations of financial institutions, mitigating the need for substantial additional investments and allowing institutions to benefit from the security and reliability of SWIFT, in addition to existing network effects. This experiment reflects a significant step in exploring blockchain technology.
in the financial sector, demonstrating potential to overcome challenges of fragmentation in tokenized assets and facilitate interoperability between traditional and emerging blockchain networks. The engagement of renowned financial institutions and market infrastructures in collaboration with technology platforms like Chainlink underscores the industry's interest and commitment to advancing the integration of blockchain technology to enhance efficiency, security, and scalability in global financial operations.

4.2 Analysis of Procedure and Result Based on Literature

The division of the project into two distinct workflows, one focusing on the technical solution and the other on non-technical aspects such as data privacy and governance, could represent a dichotomy that might not favor a holistic integration of these vital dimensions. This bifurcation, while necessary, may reflect a gap where the cohesion between technical and non-technical aspects may be lost or not fully achieved.

In the technical dimension, the experimentation employing Chainlink's Cross-Chain Interoperability Protocol (CCIP) and the development of an experimental Software Development Kit (SDK) by SWIFT are notable advancements. However, the breadth and depth of the tests conducted may be questioned, given the limited number of failure scenarios examined. As highlighted by Dubey et al. (2020), the robustness of testing is crucial to ensure that developed systems are resilient and reliable under a variety of conditions.

When examining risk management and transparency in the cross-chain transfer process, the monitoring by CCIP is a positive step. However, the effectiveness of this monitoring and the adequacy of the CCIP protocol in ensuring security and reliability in transactions may require more rigorous evaluation. Moreover, the collection of detailed information for the creation of blockchain messages, a prudent measure, can be seen as a strategy to improve cyber resilience, as discussed by Franchina & Carlomagno (2019).

The proposed solution aims to minimize the investment and adaptation needed by financial institutions, a commendable goal. However, there may be a need to assess more deeply how this minimization impacts the security, efficiency, and effectiveness of transactions, especially in a complex and ever-evolving regulatory environment.

Inferences derived from the analyses of Qiu et al. (2019), which compared Ripple and SWIFT in terms of transforming cross-border remittances using blockchain technology, underscore the relevance and potential of blockchain technology in improving efficiency and security in financial transactions. Nevertheless, the practical applicability and effective
implementation of these technologies, as explored by SWIFT, may still face significant technical and regulatory challenges.

Finally, the engagement of renowned financial institutions and market infrastructures in collaboration with technology platforms like Chainlink signals a positive sector commitment to explore and integrate blockchain technology. However, the efficacy and efficiency of this integration, as well as its widespread acceptance and adoption in the financial sector, are areas that still require more robust investigation and assessment, as suggested by Zhu Jianming, Ding Qingyang, & Gao Sheng (2019), when discussing a distributed framework for the SWIFT system based on permissioned blockchain.

4.3 Inferential Elucidation of Blockchain Integration in Financial Transactions

Inferential insights drawn from the described experiment and literature review can offer a multidimensional perspective on the integration of blockchain technology within the financial sector.

Initially, the successful implementation of 50 token transfers through the SWIFT-Chainlink collaboration suggests a significant step towards the practical application of blockchain in mainstream financial operations. However, the limited number of failure scenarios examined (approximately 20) may not fully encapsulate the breadth of potential real-world issues. An inferential analysis would suggest that a larger and more diverse set of failure scenarios should be considered to robustly test the resilience of the system under various conditions.

Furthermore, the use of the Cross-Chain Interoperability Protocol (CCIP) and the development of a Software Development Kit (SDK) signifies a commendable effort towards simplifying blockchain adoption for financial institutions. Yet, this raises questions about the trade-offs between ease of transition and the depth of integration. An inference can be made that while minimizing adaptation requirements for financial institutions is advantageous, it is also essential to ensure that this does not compromise the depth of blockchain integration, thereby potentially limiting the full realization of blockchain's capabilities within financial transactions.

The approach to privacy and governance, as separated from the technical solution, might also imply potential challenges in achieving a harmonious integration of these critical aspects. It can be inferred that a more unified approach might be necessary to address the
Integrating blockchain into global finance: a case study of SWIFT's strategic collaboration with Chainlink complexities of regulatory compliance, particularly in the dynamic landscape of international financial law.

Moreover, the reliance on SWIFT's existing security and reliability paired with blockchain's transparency could be inferred as a move to harness the strengths of both worlds. This dual approach could serve to assuage the concerns of both regulators and participants within the financial sector regarding the new technology. It suggests a potential shift in the paradigm of financial transactions, where the security and trust embedded in traditional systems like SWIFT are enhanced by the efficiency and innovation offered by blockchain technologies like Chainlink.

Lastly, the engagement of renowned financial institutions in this experiment implies a growing recognition and endorsement of blockchain's potential. This can be inferred as an indicator of the sector's readiness to move beyond the exploratory phase and towards more concrete applications of blockchain technology. It also signals a commitment to overcoming the fragmentation of tokenized assets, aiming to achieve a higher level of interoperability in the financial sector.

These inferential analyses point towards a cautiously optimistic future for blockchain in finance, where collaboration and innovation may lead to enhanced efficiency, security, and interoperability in international asset transfers. However, they also highlight the need for ongoing evaluation, robust testing, and regulatory vigilance to ensure the sustainable and secure adoption of this promising technology.

**Conclusion**

A estratégia articulada pela SWIFT (2023) destaca um marco substancial na trajetória de adoção e integração da tecnologia blockchain no âmbito financeiro. A análise, quando colocada em contraste com os discursos acadêmicos citados, desvenda uma consonância com as tendências emergentes e os desafios esboçados na literatura contemporânea. A SWIFT, ao catalisar uma interconexão segura e eficiente entre entidades financeiras e redes blockchain, utilizando sua infraestrutura pré-existente, responde de maneira pragmática à demanda por uma colaboração interinstitucional mais estreita, uma resiliência cibernética ampliada, e uma governança robusta.

The strategy articulated by SWIFT (2023) marks a substantial milestone in the trajectory of blockchain technology adoption and integration within the financial sphere. The analysis, when juxtaposed with the academic discourses cited, reveals an alignment with the
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emerging trends and challenges outlined in contemporary literature. SWIFT's initiative to catalyze a secure and efficient interconnection between financial entities and blockchain networks, leveraging its existing infrastructure, pragmatically addresses the demand for closer inter-institutional collaboration, enhanced cyber resilience, and robust governance.

This undertaking underscores the financial sector's ongoing engagement in exploring and integrating technological innovations, aimed at enhancing efficiency, security, and scalability in global financial operations. This commitment not only demonstrates a ceaseless pursuit of optimized and secure operations but also reflects a willingness to collaborate with multiple stakeholders, including renowned financial institutions and technological platforms like Chainlink, to navigate the uncharted territories presented by blockchain.

By positioning itself at the forefront of this technological integration, SWIFT not only showcases its leadership in the financial realm but also contributes to the emerging literature on the practical applicability of blockchain, providing valuable insights that may guide future research and implementations in this area. In doing so, SWIFT promotes its own relevance and resilience in the rapidly evolving financial landscape and contributes to advancing the collective understanding of how blockchain technology can be harnessed to address persistent challenges and promote a more integrated and secure global financial operation.

Furthermore, by facilitating the transition to blockchain infrastructures with minimal changes required for the involved institutions, SWIFT also points to a replicable model for other entities in the sector, thereby promoting a broader adoption of blockchain technology in a manner that is both effective and economically viable. This pragmatic approach could accelerate blockchain acceptance in the financial sector, leading to swifter transformation and a more cohesive and resilient global financial environment.

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