Conceptual Model for Evaluating Traditional Cross-Border Payment Systems and Bottleneck Identification

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Abstract- ***Traditional cross-border payment systems, predominantly based on correspondent banking networks and SWIFT messaging infrastructures, remain central to global financial transactions but are increasingly criticized for inefficiency, opacity, and high operational costs. This paper presents a conceptual model for evaluating such systems with the objective of systematically identifying inherent bottlenecks across operational, regulatory, technological, and cost dimensions. The model adopts a layered perspective, comprising inputs (originators, intermediaries, regulatory frameworks, and technological infrastructure), processes (messaging, compliance checks, foreign exchange conversion, and settlement mechanisms), and outputs (beneficiary receipt, reconciliation, and reporting). Evaluation dimensions include efficiency, cost, transparency, reliability, security, and scalability, allowing for multidimensional performance assessment. Bottleneck identification is addressed through a structured framework that highlights operational frictions such as multi-hop transactions, manual reconciliation, and legacy systems; cost drivers including intermediary fees and FX spreads; regulatory redundancies stemming from fragmented compliance standards and de-risking practices; and infrastructure limitations such as batch-based settlements and lack of real-time integration. The conceptual model contributes by offering a structured approach to analyzing the interplay between transaction flows, institutional practices, and regulatory environments that collectively shape the performance of traditional cross-border payment systems. Its application facilitates comparative assessments across geographies and use cases, providing insights into the differential impacts on retail remittances, trade finance, and corporate treasury operations. The identification of bottlenecks has direct implications for banks, regulators, policymakers, and end users, informing strategies for modernization, harmonization of compliance standards, and investment in technological upgrades. Ultimately, the model underscores the necessity of moving beyond incremental reforms toward more resilient, transparent, and inclusive cross-border payment ecosystems, while providing a diagnostic framework that can serve as a baseline for evaluating emerging alternatives such as real-time payment networks and distributed ledger-based infrastructures.***

Keywords: ***Traditional Cross-Border Payments, Correspondent Banking, Payment System Evaluation, Bottleneck Identification, Transaction Delays, Cost Analysis, Operational Inefficiency, Transparency, Reliability, Risk Management, Compliance, Scalability, Accessibility, Interbank Settlements, Cross-Border Remittances***

I. INTRODUCTION

Cross-border payment systems form the backbone of global financial integration, enabling the transfer of funds across national boundaries for purposes ranging from trade settlement to personal remittances and foreign direct investment (Menson *et al*., 2018; Scholten *et al*., 2018). Historically, the dominant mechanism for executing international payments has been correspondent banking, a system in which banks maintain reciprocal accounts—nostro and vostro accounts—to facilitate transactions across jurisdictions (Otokiti, 2012; Lawal *et al*., 2014). This framework has been operational for decades, leveraging standardized messaging protocols such as the Society for Worldwide Interbank Financial Telecommunication (SWIFT) network. While resilient and trusted, correspondent banking networks

are inherently complex, involving multiple intermediaries that each perform compliance checks, liquidity management, and reconciliation before funds reach the intended beneficiary (Amos *et al*., 2014; Otokiti and Akorede, 2018). As a result, although these systems have enabled globalization and financial interconnectivity, they are also associated with substantial operational frictions that warrant systematic evaluation (Ajonbadi *et al*., 2015; Otokiti, 2017).

The importance of assessing traditional cross-border payment systems has become more pronounced in the context of expanding global trade, increasing flows of migrant remittances, and the growing emphasis on financial inclusion. Global trade requires reliable, predictable, and efficient financial settlements to support supply chains and contractual obligations across borders (Akinbola and Otokiti, 2012; Lawal *et al*., 2014). Migrant remittances, which reached hundreds of billions of U.S. dollars annually, serve as critical lifelines for households in developing economies, where transaction costs and delays can significantly diminish their impact. Furthermore, access to affordable and transparent cross-border payment services is central to financial inclusion, particularly in regions where reliance on informal networks persists due to high costs and inefficiencies in formal channels (Ajonbadi *et al*., 2014; Ajayi, 2018). Without systematic evaluation of traditional systems, inefficiencies remain obscured, perpetuating barriers to equitable financial participation.

The rationale for identifying bottlenecks within these legacy infrastructures is rooted in the persistent challenges of delays, costs, and inefficiencies. Settlement times often range from one to five business days due to the sequential involvement of multiple correspondent banks, each introducing latency through compliance checks and manual reconciliation (Dare *et al*., 2018; Ajayi *et al*., 2018). Costs remain disproportionately high, with average transaction fees for remittances hovering between 6–10% of the transfer value, driven by intermediary fees, hidden foreign exchange spreads, and lack of competitive alternatives in certain corridors. Inefficiencies, such as reliance on batch processing rather than real-time settlement, limited interoperability between systems, and redundancy in compliance checks, further amplify friction (Etim *et al*., 2018; Ayanbode *et al*., 2018). Collectively, these bottlenecks undermine user trust, constrain economic development, and inhibit the adoption of formal financial channels.

Against this backdrop, the objective of the conceptual model proposed in this study is to provide a structured framework for evaluating traditional cross-border payment systems while systematically identifying bottlenecks across operational, regulatory, technological, and cost dimensions. The model adopts a layered perspective—inputs, processes, and outputs—enabling analysis of transaction flows and institutional practices at each stage of the payment lifecycle. By applying multidimensional evaluation criteria such as efficiency, cost, transparency, reliability, security, and scalability, the framework supports both comparative assessments across regions and diagnostic identification of systemic weaknesses. In doing so, it offers practical value to banks seeking modernization strategies, regulators aiming to harmonize compliance standards, and policymakers addressing the dual imperatives of efficiency and inclusion (Essien *et al*., 2018; Babatunde *et al*., 2018). Ultimately, the model provides a foundation for understanding how incremental and structural reforms can address long-standing frictions in traditional payment infrastructures, while setting a baseline for assessing the potential of emerging alternatives such as real-time payments and distributed ledger technologies.

II. METHODOLOGY

The PRISMA methodology applied to the development of a conceptual model for evaluating traditional cross-border payment systems and identifying bottlenecks begins with a systematic literature search across multidisciplinary databases, including finance, economics, banking technology, and international business. The scope is designed to capture peer-reviewed articles, institutional reports, central bank publications, and regulatory guidelines that describe existing cross-border payment frameworks, operational mechanisms, settlement infrastructures, and inefficiencies. Selection criteria are established to include studies focusing on traditional payment rails such as SWIFT, correspondent banking networks, and settlement

through central banks, while excluding research exclusively dedicated to emerging fintech and blockchain alternatives, unless they provide comparative insights into traditional systems. The screening process follows a structured eligibility assessment, ensuring that only works addressing system evaluation, transaction efficiency, regulatory compliance, and cost structures are retained.

Data extraction is carried out using standardized forms to capture recurring themes such as transaction speed, settlement risk, transparency gaps, compliance burdens, liquidity management, and cost layering. Particular attention is given to structural bottlenecks including reliance on correspondent chains, fragmented regulatory oversight, high operational costs, and the latency caused by time-zone and currency mismatches. This process also documents institutional and infrastructural dependencies, such as reliance on legacy messaging standards and limited interoperability across national payment systems.

The synthesis phase organizes findings into a conceptual framework that links system attributes—speed, cost, transparency, security, and compliance—with the sources of inefficiency that inhibit performance. Comparative analysis highlights differences across geographies, levels of regulatory maturity, and institutional structures, providing a multi-dimensional view of the cross-border payment ecosystem. The conceptual model derived from this process positions bottleneck identification as a systematic step that integrates economic efficiency indicators with operational and compliance risk dimensions.

Quality assessment is performed by evaluating the rigor of the included studies, their methodological approaches, and the consistency of reported performance measures. This strengthens the robustness of the resulting conceptual model by ensuring it is grounded in diverse but reliable empirical and theoretical evidence. The outcome of the PRISMA methodology is a transparent, replicable evidence base that not only diagnoses critical friction points in traditional cross-border payment systems but also offers a structured foundation for developing strategies aimed at streamlining processes, reducing costs, and enhancing systemic efficiency.

2.1 Theoretical Foundations

The evaluation of traditional cross-border payment systems and the identification of their bottlenecks require grounding in robust theoretical frameworks that can explain the interplay of institutions, technologies, and regulatory structures. Four key perspectives—systems theory, transaction cost economics, network intermediation theory, and risk and compliance frameworks—provide the analytical basis for conceptualizing the structure, functioning, and limitations of correspondent banking–based payment models.

Systems theory offers a holistic perspective for understanding the complexity of financial networks, emphasizing interdependence, feedback loops, and emergent behaviors. A cross-border payment system can be conceptualized as an open socio-technical system composed of banks, intermediaries, regulators, and technological infrastructures interacting within global financial markets (Chandrashekeran, 2016; Devaney *et al*., 2017). Each actor operates as a subsystem, contributing specific functions such as liquidity provision, message transmission, compliance enforcement, and settlement processing.

From a systems perspective, efficiency or inefficiency emerges not from isolated components but from the interactions among them. For instance, delays in settlement may result from synchronization mismatches between national clearing systems, while high costs may emerge from the cumulative layering of fees across intermediaries. Moreover, the system demonstrates characteristics of path dependency: legacy infrastructures such as SWIFT and nostro/vostro arrangements persist because of network externalities, even though they may not represent the most efficient technological option. Systems theory thus highlights how interconnectivity creates both resilience—by distributing risks across nodes—and vulnerability—by amplifying bottlenecks when critical nodes fail.

Transaction cost economics (TCE), as developed by Coase and Williamson, provides a framework for explaining the high costs and frictions inherent in traditional cross-border payment systems. According

to TCE, the efficiency of any economic arrangement depends on minimizing the costs associated with searching for information, negotiating terms, enforcing contracts, and managing uncertainty.

In international payments, transaction costs manifest in multiple forms. Search costs arise from limited transparency around fees, exchange rates, and settlement times. Bargaining and coordination costs are incurred when multiple correspondent banks negotiate and maintain reciprocal account relationships. Enforcement costs appear in the form of repeated compliance checks, monitoring for fraud, and dispute resolution (Russell, 2016; Andreisová, 2016). Uncertainty—stemming from currency fluctuations, jurisdictional differences, and potential sanctions—further elevates costs.

Traditional correspondent banking arrangements persist in part because they reduce bilateral search and enforcement costs by creating standardized channels for interbank interaction. However, the reliance on multiple intermediaries often transforms fixed costs into variable ones, passed down to end-users through high transaction fees and exchange spreads. TCE thereby clarifies why legacy infrastructures are both necessary for managing uncertainty yet simultaneously responsible for inefficiencies that modern reforms seek to address.

Network intermediation theory emphasizes the importance of intermediaries in bridging gaps between otherwise disconnected actors. In the context of cross-border payments, correspondent banks function as intermediaries linking domestic financial institutions that lack direct relationships. These intermediaries provide critical services, including liquidity management, settlement of foreign exchange transactions, and facilitation of regulatory compliance.

However, the centrality of intermediaries in correspondent banking also introduces structural bottlenecks. Each intermediary adds latency and cost to the transaction, while the opacity of the network obscures accountability. Moreover, the structure of correspondent banking networks is unevenly distributed, with a few large international banks controlling the majority of cross-border flows. This concentration creates systemic vulnerabilities, as the withdrawal of a major correspondent from a particular corridor can leave smaller institutions and countries financially isolated—a phenomenon known as "de-risking."

From a network perspective, correspondent banking exemplifies both the strength and weakness of intermediation. While it expands access by connecting fragmented domestic systems, it also amplifies inefficiencies and fragilities due to its hierarchical and centralized nature. Network intermediation theory thus helps explain why traditional payment infrastructures persist, while simultaneously exposing the sources of friction that justify reform (Lin, 2015; Rea *et al*., 2017).

A final theoretical foundation lies in the frameworks of risk management and regulatory compliance that heavily shape the architecture of cross-border payments. International payments are subject to a variety of risks, including credit risk (counterparty default), liquidity risk (failure to meet settlement obligations), operational risk (errors or cyberattacks), and legal risk (jurisdictional disputes). To mitigate these risks, regulators and international bodies impose stringent compliance requirements, particularly in the areas of anti-money laundering (AML), counter-terrorist financing (CTF), and sanctions enforcement.

While necessary for maintaining financial integrity, compliance frameworks contribute significantly to bottlenecks in traditional systems. Each intermediary in the correspondent chain performs its own Know-Your-Customer (KYC) and transaction monitoring checks, leading to redundancy, delays, and increased costs. Moreover, fragmented regulatory regimes across jurisdictions create inconsistencies, compelling banks to adopt the most conservative compliance approach to minimize exposure. This phenomenon incentivizes "de-risking," where banks sever relationships with institutions in high-risk regions, thereby exacerbating financial exclusion.

Risk and compliance frameworks also reinforce the persistence of legacy infrastructures. Established systems such as SWIFT provide standardized messaging formats that facilitate regulatory reporting, making it difficult for new entrants or alternative technologies to gain adoption without parallel compliance mechanisms. Thus, while these frameworks enhance the security and legitimacy of

cross-border payment systems, they simultaneously entrench inefficiencies and limit innovation.

Together, these four theoretical perspectives illuminate the structural dynamics of traditional cross-border payment systems. Systems theory highlights the interconnectedness and emergent bottlenecks of complex financial networks. Transaction cost economics explains why multiple intermediaries elevate costs even while managing uncertainty. Network intermediation theory contextualizes the central role of correspondent banks as both enablers of connectivity and sources of systemic fragility (Spagnoletti *et al*., 2015; Bounfour, 2016). Finally, risk and compliance frameworks reveal the regulatory imperatives that shape operational practices, often at the expense of efficiency and inclusivity. Grounded in these foundations, the conceptual model proposed in this study systematically evaluates traditional systems to identify inefficiencies and provide a baseline for modernization efforts.

2.2 Conceptual Model Components

The conceptual model for evaluating traditional cross-border payment systems can be understood through three interlinked layers—input, process, and output. These layers define the flow of financial transactions from initiation to final receipt, while simultaneously highlighting the complexity, systemic dependencies, and points at which bottlenecks emerge (Bookstaber and Kenett, 2015; Jabotinsky, 2017). By decomposing the system into components, it becomes possible to systematically analyze inefficiencies and propose targeted interventions that enhance overall performance and reliability.

The input layer represents the starting point of any cross-border payment and comprises the key actors, institutional mechanisms, and regulatory frameworks that establish the foundation for a transaction. The originator may be an individual consumer, a business enterprise, or an institution seeking to transfer value across jurisdictions. Each originator brings distinct requirements: retail remittances often emphasize affordability and speed, whereas corporate transactions prioritize reliability, reconciliation, and compliance assurance.

Intermediary institutions occupy a central role at this stage, forming the structural backbone of traditional systems. Local banks, correspondent banks, and clearing houses ensure access to foreign networks and currencies. The reliance on correspondent banking relationships reflects the absence of direct connectivity between most financial institutions globally, necessitating chains of intermediaries to bridge transactional gaps. This structure, while functional, introduces cost layering and increases exposure to delays and settlement risk.

Equally critical within the input layer are regulatory and compliance requirements, which impose stringent obligations such as Anti-Money Laundering (AML) controls, Know Your Customer (KYC) verification, and sanctions screening. These requirements are essential for safeguarding financial integrity and deterring illicit flows, but they also represent significant friction points when processes are duplicated at multiple stages. The overlap of local and international compliance regimes further complicates transaction flows, especially when different jurisdictions maintain divergent regulatory priorities.

Technological infrastructure forms the final component of the input layer. Legacy systems such as SWIFT messaging standards remain dominant for interbank communication, while settlement processes often rely on central bank or correspondent arrangements. These infrastructures provide resilience and global reach but lack real-time interoperability, creating inefficiencies compared to emerging digital systems. Thus, the input layer is characterized by a balance between global connectivity, compliance obligations, and infrastructural constraints that collectively define the initiation of cross-border transactions.

The process layer captures the dynamic activities that occur once a payment instruction has been initiated. Central to this layer is the transmission of payment messages across networks, often facilitated by SWIFT. Although standardized, message transmission can encounter delays due to cut-off times, message formatting issues, or manual interventions required by intermediary banks. The rigidity of messaging protocols often prevents seamless real-time tracking, reducing transparency for both originators and

beneficiaries (Specht and Samii, 2016; Burg *et al*., 2017).

Currency conversion and foreign exchange (FX) spreads represent another critical process. Cross-border payments almost invariably involve currency exchange, and the conversion rates applied can substantially influence the cost of the transaction. FX spreads often reflect not only market conditions but also institutional margins, leading to high costs, particularly for smaller transactions or in corridors with limited competition.

Clearing and settlement mechanisms follow, involving the actual transfer of funds between institutions. Clearing ensures validation and matching of payment instructions, while settlement finalizes the transfer of value. In traditional systems, settlement is often delayed by reliance on batch processing, time-zone mismatches, and layered correspondent accounts. This leads to liquidity being tied up in nostro and vostro accounts, creating inefficiencies in global liquidity management.

Compliance checks are not confined to the input stage but recur throughout the process layer. Intermediary institutions re-screen transactions to ensure ongoing compliance with sanctions, AML, and counter-terrorist financing rules. While essential, repeated compliance checks create duplication, increase processing times, and expose transactions to rejection risks at multiple points.

Liquidity management constitutes the final dimension of the process layer. Banks must maintain sufficient balances in nostro and vostro accounts to honor obligations, but this immobilizes capital and adds to operational costs. Inefficient liquidity management often emerges as a bottleneck in high-volume corridors, reinforcing the systemic challenges inherent in legacy cross-border systems.

The output layer represents the culmination of the transaction, wherein funds are credited to the beneficiary. For individuals, this involves direct access to funds through bank accounts or cash-out services, while for businesses and institutions it involves timely confirmation of receipt to support reconciliation processes. Delays or errors at this stage directly undermine trust in the system, as beneficiaries expect certainty in both timing and value.

Confirmation and reconciliation processes are integral to ensuring transparency and reliability. Beneficiaries and originators alike require confirmation that funds have been received and credited without errors or deductions (Hughes and Middlebroo, 2015; Téllez and Zeadally, 2017). In practice, reconciliation is complicated by limited transaction visibility across correspondent chains, resulting in incomplete or delayed confirmations. This lack of end-to-end traceability is a widely cited weakness of traditional systems.

The final component of the output layer comprises reporting and auditing requirements. Regulatory and institutional obligations demand that each transaction be recorded, archived, and made available for inspection by auditors or supervisory authorities. These requirements ensure accountability and compliance but also impose additional costs and administrative burdens on institutions managing cross-border flows.

The conceptual model structured around input, process, and output layers reveals the complexity of traditional cross-border payment systems (Stahl and Tung, 2015; Hofmann *et al*., 2017;). Each component contributes to the functionality of global financial flows but simultaneously introduces inefficiencies that manifest as high costs, delays, and operational risks. By systematically decomposing the transaction journey into layered components, it becomes possible to pinpoint bottlenecks—such as duplicative compliance checks, correspondent dependency, FX spreads, and liquidity immobilization—that hinder efficiency. This layered framework thus provides not only an analytical lens for evaluation but also a foundation for designing targeted interventions aimed at streamlining global payment systems.

2.3 Evaluation Dimensions

The performance of traditional cross-border payment systems can be assessed across multiple dimensions that reflect operational, economic, and regulatory realities as shown in figure 1. Each dimension captures a distinct aspect of system functionality and highlights potential bottlenecks that undermine efficiency and

inclusivity. The following subsections—efficiency, cost, transparency, reliability, security and risk management, and scalability and accessibility—constitute a multidimensional evaluation framework for diagnosing the strengths and weaknesses of correspondent banking–based infrastructures.

Efficiency is a core dimension for evaluating cross-border payments, as it directly determines the speed and effectiveness of global financial transactions.

Transaction time, measured from initiation to final settlement, is often protracted in traditional systems, ranging from one to five business days. Delays stem from time-zone differences, sequential compliance checks, and reliance on batch processing (Burgess *et al*., 2015; Wang *et al*., 2016). This lag is problematic for businesses that require just-in-time cash flow or households dependent on remittance transfers for daily consumption.

The number of intermediaries involved is another critical determinant of efficiency. Payments frequently pass through multiple correspondent banks, each adding a step of messaging, liquidity management, and compliance screening. The more intermediaries included in the chain, the greater the risk of miscommunication, settlement delays, and operational errors.

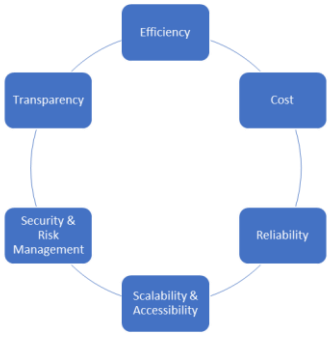

Figure 1: Evaluation Dimensions

Processing complexity compounds these challenges. Manual reconciliation, outdated IT infrastructure, and the lack of real-time interoperability between national clearing systems all contribute to inefficiencies. Unlike domestic real-time payment systems, cross-border transfers remain constrained by legacy technologies, resulting in slow and fragmented transaction pathways.

The cost of international transfers remains a prominent source of user dissatisfaction and financial exclusion.

Fees charged to originators and beneficiaries can be disproportionately high, particularly for low-value remittances. Global averages indicate costs of 6–10% per transaction, well above the Sustainable Development Goal target of 3%. These fees include explicit charges levied by sending and receiving institutions.

Beyond overt charges, hidden costs represent a significant burden. Foreign exchange (FX) spreads are often opaque, with banks applying margins substantially higher than wholesale rates. Intermediary banks may deduct additional charges en route, eroding the value received by beneficiaries. These cumulative costs disproportionately affect migrants and small businesses operating with narrow margins.

Operational overhead also contributes to high costs. Banks must maintain expensive nostro/vostro account arrangements, invest in compliance departments, and manage reconciliation processes, all of which increase fixed costs that are eventually passed on to customers. This cost structure reduces competitiveness and discourages usage of formal channels, perpetuating reliance on informal transfer networks.

Transparency is vital for building user trust and ensuring predictability in cross-border payments.

Visibility into transaction status is often limited in traditional systems. Customers frequently lack real-time updates on the location or status of their funds. The absence of end-to-end tracking can create uncertainty, leading to customer dissatisfaction and disputes.

The predictability of costs and settlement time is also weak. Users are often unaware of the final fees, exchange rates, or timeframes until after the transaction is complete. Intermediaries may deduct charges without prior disclosure, and settlement times may vary unpredictably depending on the jurisdictions and correspondent banks involved.

The lack of transparency not only diminishes user confidence but also reduces competitiveness, as consumers are unable to make informed choices

between service providers. In this way, transparency deficits exacerbate both cost and efficiency challenges.

Reliability measures the consistency and dependability of payment systems in delivering funds as intended.

The frequency of settlement failures or rejections poses a significant challenge. Transactions may be blocked due to incomplete information, insufficient liquidity, or failed compliance checks. These failures disrupt trade finance operations and create hardship for retail users.

Error handling and dispute resolution mechanisms are often cumbersome and slow. Rectifying failed payments can require weeks of correspondence between multiple banks, with costs borne by customers (Rwabukandaiga, 2015).

Compliance-driven delays represent another reliability bottleneck. Stringent anti-money laundering (AML) and counter-terrorist financing (CTF) requirements often lead to extended screening times. While necessary for safeguarding financial integrity, redundant compliance checks across jurisdictions reduce reliability and predictability.

Security and risk management are integral to cross-border payments, given the high value and sensitive nature of transactions.

Fraud detection and mitigation represent ongoing challenges. Cross-border payments are particularly vulnerable to fraudulent schemes such as phishing, account takeovers, and transaction redirection (Sabillon *et al*., 2016; Moid, 2018). Multi-layered verification processes mitigate risks but simultaneously add friction to legitimate transfers.

Cybersecurity risks in SWIFT and related infrastructures remain a concern. While SWIFT has implemented its Customer Security Programme, high-profile breaches demonstrate that weak points often exist at the endpoints—local banks with insufficient cybersecurity measures. A single compromised participant can jeopardize broader system integrity.

The risk of sanctions and regulatory non-compliance adds another layer of vulnerability. Institutions face significant penalties for inadvertently processing payments linked to sanctioned entities or jurisdictions. This risk drives conservative behavior, including de-risking strategies that exclude certain regions, thereby limiting financial inclusion.

Scalability and accessibility determine the capacity of traditional payment systems to support global financial needs equitably.

The ability to support high transaction volumes is limited by batch-processing architectures and manual reconciliation requirements. As cross-border transaction volumes grow, particularly with expanding e-commerce and global remittance flows, traditional infrastructures struggle to meet demand without significant cost escalation.

Access for SMEs and underserved regions is constrained by the concentration of correspondent banking services among a few large global banks. Smaller institutions, particularly in emerging markets, often face exclusion due to de-risking practices. This reduces the availability of affordable and reliable cross-border services for small businesses and migrant households.

The impact of legacy technology on scaling is significant. Outdated IT systems and reliance on non-standardized messaging formats hinder integration with modern, API-based or real-time infrastructures. This technological lag limits the adaptability of traditional systems to evolving global payment needs.

Collectively, these six evaluation dimensions highlight the multifaceted challenges embedded in traditional cross-border payment systems. Inefficiency arises from delays, intermediaries, and processing complexity; high costs and hidden charges undermine affordability; lack of transparency diminishes trust; weak reliability reduces predictability; security and compliance imperatives introduce friction; and scalability limitations hinder inclusivity. By structuring evaluation around these dimensions, the conceptual model not only diagnoses systemic bottlenecks but also establishes a foundation for comparative analysis with emerging alternatives. Such evaluation is critical for guiding modernization, regulatory harmonization, and investment in next-generation infrastructures capable of delivering cross-

border payments that are efficient, affordable, transparent, reliable, secure, and accessible (Parsa and Keivani, 2016; Colombo *et al*., 2017).

2.4 Bottleneck Identification Framework

Cross-border payment systems are vital to the functioning of international trade, remittances, and global financial markets. However, their effectiveness is often undermined by structural inefficiencies that manifest as bottlenecks across operational, cost, regulatory, infrastructure, and geopolitical dimensions. A systematic bottleneck identification framework provides a structured lens to uncover where and how these frictions emerge as shown in figure 2 . By categorizing them into distinct yet interrelated domains, it becomes possible to understand the root causes of inefficiencies and inform targeted interventions.

Operational bottlenecks are among the most visible inefficiencies in traditional cross-border payment systems. The involvement of multiple intermediaries, often in the form of local banks, correspondent banks, and clearing houses, increases friction at every stage of the transaction. Each intermediary introduces delays, additional costs, and risks of error propagation. The absence of direct connectivity between most financial institutions necessitates reliance on complex chains, creating opacity and limiting accountability.

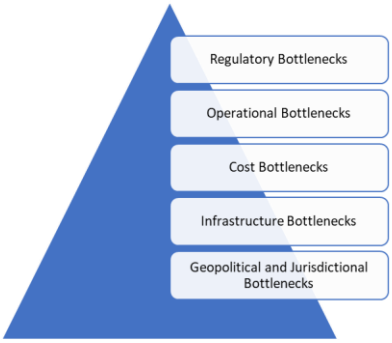

Figure 2: Bottleneck Identification Framework

Manual processes remain a significant barrier to efficiency, especially in reconciliation and compliance functions. Payment instructions frequently require manual verification or adjustment, leading to inconsistencies in processing times. In cases where compliance checks trigger alerts, manual intervention may be prolonged, contributing to payment delays that undermine reliability.

Legacy IT systems further exacerbate operational inefficiencies. Many banks continue to operate on outdated platforms that lack interoperability with modern systems. This results in slow message processing, limited transparency, and an inability to provide real-time updates. The rigidity of these systems also constrains the ability of institutions to integrate with emerging technologies, leaving them locked into inefficient processes that perpetuate bottlenecks (Teece, 2016; Petrakaki and Kornelakis, 2016).

The cost dimension of bottlenecks significantly impacts both individuals and businesses engaging in cross-border transfers. High correspondent banking fees represent a persistent challenge, as each intermediary levies charges that cumulatively increase the total cost of a transaction. This disproportionately affects smaller-value transfers such as migrant remittances, where fees can constitute a substantial percentage of the total amount.

Double charging in multi-hop transactions further compounds costs. When funds must pass through multiple correspondent banks before reaching the beneficiary, each institution applies its own fee structure. This layering effect creates opaque and unpredictable cost structures that discourage usage and reduce efficiency.

Foreign exchange (FX) margins present another major cost bottleneck. Institutions frequently exploit spreads between wholesale and retail exchange rates, applying margins that significantly inflate the expense of transactions. For smaller currencies or less liquid corridors, the spreads can be particularly wide, eroding the value transferred to beneficiaries. These cost inefficiencies highlight the lack of competitive pressure in certain corridors and underscore the structural imbalances inherent in the system.

Regulatory bottlenecks are deeply embedded in the compliance architecture of cross-border payment systems. Redundant compliance checks across jurisdictions are a common source of friction. Each intermediary institution conducts its own screening for Anti-Money Laundering (AML), Know Your

Customer (KYC), and sanctions compliance, often duplicating checks that were already performed by upstream actors. While necessary for maintaining integrity, this redundancy delays processing and increases costs.

Fragmented regulatory standards exacerbate this problem. The absence of harmonized rules across jurisdictions forces institutions to navigate divergent compliance regimes, leading to inefficiencies in cross-border coordination. For example, a transaction acceptable under one jurisdiction's framework may be flagged or rejected under another's, causing operational delays and increasing legal risks.

De-risking practices by global banks represent another critical bottleneck. In response to heightened regulatory scrutiny, many large international banks have reduced correspondent relationships with institutions in higher-risk jurisdictions. This reduces access to the global financial system for entire regions, particularly developing economies, limiting their integration into international trade and finance.

The technical infrastructure underpinning cross-border payments introduces additional bottlenecks. Many traditional systems rely on batch processing rather than real-time settlement, creating delays and liquidity inefficiencies. Settlement can take multiple days, particularly across time zones, immobilizing funds and generating uncertainty for beneficiaries.

Limited API integration and automation further constrain efficiency. Legacy systems are often incapable of seamlessly connecting with modern digital platforms, requiring manual data transfer and reconciliation. This not only slows transaction processing but also increases the likelihood of human error.

Concentration risk in SWIFT and central clearing systems represents a systemic infrastructure bottleneck. While SWIFT provides global reach, its dominance creates a single point of dependency for message transmission. Similarly, reliance on a few central clearing systems exposes the global financial ecosystem to systemic vulnerabilities, where technical disruptions or cyberattacks could paralyze cross-border flows (Mandel, 2017; Corbet and Gurdgiev, 2017).

Geopolitical and jurisdictional bottlenecks add a further layer of complexity to cross-border payment systems. Sanctioned countries face restricted access to international payment networks, which severely limits their ability to engage in global financial activity. While sanctions serve geopolitical objectives, they also create humanitarian and economic challenges by restricting remittance flows and trade financing.

Cross-border legal disputes and the absence of harmonized legal frameworks further constrain efficiency. Transactions often involve multiple jurisdictions, each with distinct legal and contractual standards. Disputes over settlement failures or compliance breaches can be difficult to resolve, creating legal uncertainty that discourages participation.

Political risks in correspondent banking corridors amplify these challenges. Shifts in diplomatic relations, sudden regulatory changes, or instability within specific regions can disrupt correspondent relationships, leading to transaction delays or the complete loss of access to payment networks. This introduces volatility and unpredictability into systems that ideally should provide stability and trust.

The bottleneck identification framework demonstrates that inefficiencies in cross-border payment systems are not isolated but span operational, cost, regulatory, infrastructure, and geopolitical dimensions. These bottlenecks are mutually reinforcing, with operational frictions amplifying cost inefficiencies, and regulatory complexity exacerbating infrastructure limitations. By systematically categorizing these challenges, the framework provides an evidence-based foundation for targeted reforms. Such reforms could include harmonizing compliance standards, modernizing technological infrastructure, reducing correspondent dependency, and addressing geopolitical risks through coordinated policy efforts. Ultimately, overcoming these bottlenecks is critical for transforming traditional cross-border payment systems into more transparent, efficient, and resilient mechanisms capable of supporting the demands of a globally interconnected economy.

2.5 Model Application

The conceptual model for evaluating traditional cross-border payment systems and identifying bottlenecks gains its practical utility through application in real-world contexts. By enabling comparative assessments across regions, tailoring evaluations to specific use cases, and conducting scenario-based analyses of bottleneck effects, the model provides a structured diagnostic framework (Fauré, *et al*., 2017; Falconi and Palmer, 2017). These applications allow for both empirical insights and actionable recommendations for policymakers, financial institutions, and businesses navigating the challenges of international payments.

Cross-border payment systems display significant heterogeneity depending on regional infrastructures, regulatory environments, and market dynamics. Applying the conceptual model facilitates comparative assessments across geographies.

In Africa, retail remittances dominate cross-border flows, representing critical sources of household income. However, payment corridors into and within the continent often exhibit high costs, averaging above 8% per transaction, far exceeding the global target of 3%. Bottlenecks are most pronounced in efficiency, transparency, and accessibility dimensions. Weak technological infrastructures, fragmented regulatory frameworks, and extensive reliance on intermediary banks contribute to delays and high fees. De-risking practices by global correspondent banks further exacerbate exclusion, limiting smaller institutions' access to international networks.

By contrast, Europe presents a more mature interbank transfer ecosystem. Intra-European payments benefit from harmonized regulations under the Single Euro Payments Area (SEPA), which has introduced faster and more predictable settlement mechanisms. Interbank transfers within the eurozone demonstrate lower costs and greater transparency compared to African corridors. However, when European banks engage in transfers outside the SEPA zone, they revert to legacy correspondent banking pathways, reintroducing bottlenecks such as settlement delays, multiple intermediaries, and hidden foreign exchange spreads. Comparative application of the model thus highlights disparities: while Africa illustrates systemic inefficiencies rooted in infrastructure and accessibility, Europe exemplifies the conditional efficiency of regional integration that falters in global contexts.

Beyond regional differences, the conceptual model gains depth when applied to specific use cases, as bottlenecks manifest differently depending on transaction type.

For retail remittances, efficiency, cost, and accessibility are the most critical dimensions. Migrant workers sending small-value payments require affordable, transparent, and timely services. Traditional systems, with multiple intermediaries and opaque fee structures, often fail to meet these requirements. High fixed costs per transaction disproportionately affect low-value transfers, underscoring the bottleneck of cost inefficiency.

In corporate treasury payments, the primary concerns are reliability, predictability, and security. Corporations engaged in cross-border trade must manage liquidity across multiple jurisdictions. Here, bottlenecks arise from compliance-driven delays and settlement failures, which can disrupt working capital cycles. While fees may be more acceptable for corporations compared to individuals, the unpredictability of settlement times undermines treasury management efficiency.

Trade finance illustrates a third use case where complexity and compliance dominate. Letters of credit and other instruments rely heavily on correspondent banking networks, creating multiple checkpoints for validation, document verification, and settlement. Bottlenecks emerge in processing complexity and regulatory redundancy, as compliance requirements differ across jurisdictions (Kwon, 2017; Howlett *et al*., 2017). These inefficiencies hinder the speed and scalability of trade finance, impacting exporters and importers alike.

By differentiating between retail, corporate, and trade use cases, the model demonstrates its versatility in diagnosing how bottlenecks map onto distinct operational and strategic priorities.

Scenario analysis provides a dynamic extension of the conceptual model, allowing stakeholders to anticipate how bottlenecks propagate under varying conditions.

One scenario might simulate increased compliance intensity in response to heightened anti-money laundering (AML) regulations. The model predicts that efficiency would deteriorate due to prolonged screening, reliability would decline as transaction rejections increase, and costs would rise from expanded compliance overhead. The scenario illustrates how regulatory tightening, while enhancing security, can inadvertently magnify systemic frictions.

Another scenario could explore intermediary concentration risk, such as the withdrawal of a major correspondent bank from a specific corridor due to de-risking. The model anticipates reduced accessibility for smaller institutions, heightened costs as competition diminishes, and compromised reliability as transaction rerouting introduces new delays. This scenario is particularly relevant for regions dependent on a small number of correspondent relationships, where the exit of one player can significantly disrupt financial flows.

A third scenario might examine technology stagnation, in which legacy infrastructures persist without modernization. Here, scalability becomes the critical bottleneck, as increasing transaction volumes from global e-commerce and migration strain outdated systems. Efficiency would also decline, as batch-based processing cannot meet the demand for real-time transactions. Such a simulation underscores the urgency of investing in technological upgrades to avoid systemic overload.

Scenario analysis thus highlights the model's predictive value: it not only diagnoses existing bottlenecks but also forecasts how they evolve under stress conditions, enabling proactive policy and strategic interventions.

Through regional comparisons, use-case differentiation, and scenario-based simulations, the conceptual model demonstrates its capacity to generate practical insights into the functioning of traditional cross-border payment systems. Regional assessments expose disparities between mature and underdeveloped payment ecosystems, use-case analyses reveal how bottlenecks align with distinct stakeholder priorities, and scenario simulations offer foresight into the systemic consequences of regulatory, operational, or technological changes. Collectively, these applications establish the model as a versatile tool for evaluating legacy infrastructures and guiding reform strategies toward more efficient, inclusive, and resilient cross-border payment ecosystems (Schweizer *et al*., 2016; Becker *et al*., 2017).

2.6 Implications for Stakeholders

The persistence of inefficiencies and bottlenecks in traditional cross-border payment systems has significant implications for the various stakeholders involved in their operation and use. Banks, regulators, businesses, consumers, and policymakers each experience the consequences in distinct ways, but they are also positioned to influence solutions as shown in figure 3. A stakeholder-centered analysis highlights the interdependencies between actors and underscores the necessity of collective action to modernize and reform cross-border financial infrastructures.

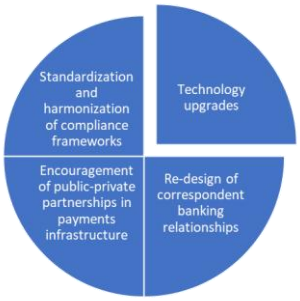

Figure 3: Pathways for Improvement

For banks, the implications of traditional inefficiencies are particularly acute. Institutions relying on outdated infrastructures and manual processes face increasing pressure to modernize, automate, and optimize costs. Correspondent banking relationships, once a cornerstone of cross-border payments, have become expensive and operationally burdensome. The persistence of multi-hop transactions, duplicative compliance checks, and high liquidity costs undermines banks' profitability and competitiveness.

Modernization is therefore a critical requirement. Transitioning from legacy IT systems to interoperable

digital platforms is necessary to provide transparency, real-time settlement, and seamless integration with clients' business systems. Automation plays a complementary role, especially in reconciliation and compliance workflows. By leveraging technologies such as artificial intelligence for sanctions screening and machine learning for fraud detection, banks can reduce manual intervention, improve accuracy, and shorten transaction cycles (Bhasin, 2016; Vinayakumar *et al*., 2017).

Cost optimization is also central to banks' strategic response. Pressure from fintech competitors and customer demand for lower fees compels banks to re-engineer their processes and renegotiate correspondent relationships. Without substantive modernization, traditional institutions risk disintermediation by digital-first providers that can offer faster, cheaper, and more transparent alternatives.

Regulators occupy a pivotal role in shaping the compliance environment within which cross-border payments operate. Current inefficiencies reveal the urgent need for harmonization of compliance standards and supervisory frameworks. Divergent Anti-Money Laundering (AML), Know Your Customer (KYC), and sanctions regulations across jurisdictions create redundant checks, inconsistent enforcement, and transaction delays.

For regulators, harmonization is not merely a technical exercise but a systemic necessity. Establishing common standards for data-sharing, customer due diligence, and transaction monitoring would streamline compliance, reduce duplication, and enhance effectiveness in combating illicit finance. Global initiatives, such as those led by the Financial Action Task Force (FATF), provide an important foundation, but their implementation remains uneven across countries.

Supervisory frameworks also need recalibration to account for technological innovations in the payments landscape. As fintech firms and digital-native providers enter the cross-border space, regulators must ensure a level playing field while safeguarding financial integrity. This requires balancing innovation and risk management, emphasizing proportional regulation that promotes competition while preserving trust in the system.

The implications for businesses and consumers are felt most directly in terms of cost, speed, and transparency. For businesses engaged in international trade, delays in clearing and settlement disrupt cash flow management and increase working capital costs. High fees and unpredictable foreign exchange spreads reduce competitiveness, particularly for small and medium-sized enterprises (SMEs) with limited bargaining power. Lack of transparency in fee structures further complicates financial planning and reconciliation.

Consumers, particularly migrant workers sending remittances, face similar challenges. Cross-border transfers often involve disproportionately high costs relative to transaction value, undermining the developmental impact of remittance flows. Delays in receipt also impose social and economic burdens on households that rely on remittances for essential needs. The demand for faster, cheaper, and more transparent alternatives is therefore intensifying, driving adoption of fintech solutions and digital wallets that bypass traditional correspondent chains.

This shift underscores a broader risk for traditional systems: failure to adapt could accelerate customer migration toward non-bank alternatives, reducing banks' relevance in cross-border finance. Businesses and consumers alike increasingly expect the kind of seamless, real-time experience delivered by domestic payment innovations, and their dissatisfaction places pressure on incumbents to reform (Parise *et al*., 2016; Skinner, 2016).

For policymakers, the implications of bottlenecks in cross-border payments are closely tied to broader concerns about financial inclusion and economic development. The persistence of high costs and limited access disproportionately affects individuals and businesses in developing economies, where correspondent de-risking and regulatory fragmentation reduce integration into the global financial system.

Reducing financial exclusion in cross-border payments is thus a policy priority. By promoting accessible, affordable, and reliable payment channels, policymakers can facilitate remittance flows, enhance trade participation, and strengthen the resilience of domestic economies. This requires coordinated

international efforts to address de-risking, incentivize infrastructure modernization, and expand access to digital financial services.

Policymakers must also recognize the geopolitical dimensions of cross-border payments. Sanctions regimes, jurisdictional disputes, and concentration risks in global infrastructures expose vulnerabilities that can have far-reaching economic consequences. Policy frameworks need to balance geopolitical objectives with the imperative of maintaining inclusive, resilient financial networks that serve global public goods.

The implications of inefficiencies in cross-border payment systems extend across multiple stakeholder groups, from banks grappling with modernization pressures to consumers seeking affordability and speed, and from regulators working toward harmonization to policymakers focused on financial inclusion. The interconnected nature of these challenges underscores the need for collaborative, multi-stakeholder strategies. Addressing bottlenecks through modernization, regulatory alignment, and inclusive policy design is critical to transforming traditional systems into efficient, transparent, and accessible infrastructures capable of meeting the demands of a rapidly evolving global economy.

2.7 Pathways for Improvement

The persistence of inefficiencies in traditional cross-border payment systems necessitates a comprehensive set of reform pathways aimed at reducing costs, improving speed, enhancing transparency, and broadening accessibility. The conceptual model's diagnostic framework identifies four priority areas for intervention: regulatory harmonization, technological modernization, restructuring correspondent banking relationships, and fostering collaborative public-private partnerships (Bachev *et al*., 2016; Ganguli and Ebrahim, 2017). Each pathway addresses a distinct source of systemic bottlenecks while collectively contributing to the development of a more inclusive and resilient payment ecosystem.

Regulatory fragmentation remains a central obstacle in cross-border payments, with divergent anti-money laundering (AML), counter-terrorist financing (CTF), and sanctions compliance standards across jurisdictions. Standardization and harmonization of compliance frameworks can reduce redundancy, lower transaction delays, and improve reliability. Efforts such as the Financial Action Task Force (FATF) recommendations provide a global benchmark, yet implementation varies widely. Greater convergence on compliance protocols, supported by mutual recognition agreements and interoperable digital KYC utilities, would minimize duplicative checks and streamline transaction flows. Such harmonization would not only mitigate costs for banks but also enhance predictability and trust for end-users.

Modernizing technological infrastructures is equally vital for addressing bottlenecks related to efficiency, transparency, and scalability. The adoption of ISO 20022, a global messaging standard, enhances interoperability and enriches data carried within payment messages, enabling faster reconciliation and improved compliance screening. Similarly, API-driven integration facilitates real-time communication between banks, fintechs, and clearing houses, reducing reliance on batch processing and enabling greater transparency in transaction tracking.

In addition, distributed ledger technology (DLT) pilots offer a promising avenue for rethinking settlement processes. While full-scale adoption remains nascent, pilot initiatives demonstrate the potential for atomic settlement—simultaneous exchange of value and information—thereby reducing counterparty risk and settlement delays. Technology upgrades, when implemented with robust security measures, can create a foundation for next-generation cross-border systems that combine speed and reliability with compliance integrity.

Correspondent banking, while central to legacy infrastructures, requires structural redesign to address inefficiencies and concentration risks. Traditional multi-hop arrangements, where payments traverse multiple intermediaries, can be streamlined by fostering direct correspondent relationships in key corridors. Regional payment hubs, supported by central banks or cooperative networks, can further reduce dependency on global intermediaries and improve efficiency in underserved regions.

Additionally, greater transparency in fee structures within correspondent chains would address cost-

related bottlenecks. Incentivizing innovation within correspondent banking—such as pre-validation of beneficiary details and shared utilities for compliance—can mitigate error rates and accelerate settlement times. A redesigned correspondent banking ecosystem, with fewer intermediaries and greater operational transparency, would strengthen both resilience and accessibility.

Finally, public-private collaboration is essential for aligning innovation with regulatory oversight and ensuring inclusivity. Public-private partnerships (PPPs) can bridge investment gaps in technological infrastructure, particularly in emerging markets where high costs deter private-sector initiatives (Trebilcock and Rosenstock, 2015; Ahmad *et al*., 2017). Central banks, working alongside commercial banks, fintechs, and international organizations, can co-develop interoperable platforms that address local constraints while maintaining global connectivity.

Examples include regional cross-border payment schemes, such as the Pan-African Payment and Settlement System (PAPSS), which aim to reduce reliance on external correspondent banks. Similarly, joint innovation sandboxes enable regulators and private firms to experiment with technologies like DLT under controlled conditions. By sharing resources and aligning incentives, PPPs foster innovation while safeguarding financial stability and compliance integrity.

Pathways for improvement require a balanced combination of regulatory, technological, structural, and collaborative reforms. Standardized compliance frameworks reduce regulatory bottlenecks; technology upgrades modernize core infrastructures; redesigned correspondent relationships enhance efficiency and reduce costs; and PPPs extend inclusivity while aligning innovation with oversight (Al Saghier and Alrabiah, 2016; Walker, 2017). Collectively, these pathways represent a forward-looking strategy for transforming traditional cross-border payment systems into efficient, secure, and transparent networks capable of supporting global trade, remittances, and financial inclusion.

CONCLUSION

Traditional cross-border payment systems, while foundational to international commerce and remittance flows, remain burdened by persistent inefficiencies. Reliance on multiple intermediaries increases friction, while legacy IT systems limit interoperability and transparency. High costs stemming from correspondent banking fees, foreign exchange spreads, and duplicative compliance checks impose significant burdens on both businesses and consumers. Furthermore, fragmented regulatory standards and geopolitical constraints exacerbate these challenges, leaving many regions underserved and excluded from efficient financial integration. These inefficiencies collectively undermine the speed, reliability, and inclusivity of cross-border payment systems, exposing the urgent need for reform.

The conceptual model developed to evaluate these systems provides a structured framework for diagnosing bottlenecks across input, process, and output layers. By systematically decomposing transaction flows, the model highlights where inefficiencies are most likely to occur, from operational delays and compliance redundancies to infrastructure dependencies and geopolitical vulnerabilities. This analytical clarity is essential for distinguishing between frictions that can be addressed through technological modernization and those that require regulatory harmonization or policy intervention. The model's value lies not only in its diagnostic precision but also in its capacity to inform the design of more resilient, transparent, and cost-effective systems.

Looking forward, the roadmap for transitioning toward modernized, efficient, and inclusive cross-border payment ecosystems must prioritize three objectives: technological innovation, regulatory cooperation, and policy-driven inclusion. Technological modernization, including real-time settlement, API integration, and automation, can significantly reduce operational frictions. Regulatory harmonization across jurisdictions can streamline compliance, reducing redundancy without compromising financial integrity. Finally, policies focused on reducing financial exclusion can ensure that the benefits of modernization extend to

underserved regions and populations. Together, these efforts offer a pathway toward a global payment ecosystem that is not only efficient and secure but also equitable and inclusive.

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