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Macro-Fiscal Optimization and Automated Revenue Mobilization: Evaluation of Digital Tax Architectures in Fragile Sub-Saharan Economies Under the Domesticated East African Community Legal Framework

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Abstract

This paper examines macro-fiscal optimization frameworks in sub-Saharan Africa, focusing strictly on the internal financial architectures and digital tax technologies that drive domestic resource mobilization. While regional economies project stable growth rates between 4.1% and 4.3% in 2026, systemic revenue leakage, manual clearance inefficiencies, and corporate underreporting continue to undermine long-term fiscal sustainability. This study models how transitioning from paper-based customs operations to fully automated, digital fiscal ecosystems expand the sovereign tax base. It evaluates three critical financial pillars: complete cashless bank remittances, cryptographic tax exemption verification, and automated Customs-to-e-Tax database synchronization under the Mandatory Taxpayer Identification Number framework. Using Laffer's Optimum Taxation Theory, the paper demonstrates that lowering transaction costs and closing administrative enforcement gaps increases voluntary tax compliance and secures resources for government service delivery. The paper concludes with actionable policy recommendations for revenue executives to minimize fiscal leakages and fund resilient public infrastructure.

Keywords: Revenue administration; Fiscal digitalization; Customs-to-e-Tax syncing; Domestic resource mobilization; Cryptographic verification; Fragile economies

Introduction

The capacity of a state to deliver essential public services, construct critical infrastructure, and maintain institutional stability depends heavily on its ability to generate sustainable domestic revenue [1]. In many developing and fragile sub-Saharan countries, this fiscal foundation is weakened by an over-reliance on manual border administration systems that treat customs enforcement and trade facilitation as competing priorities [2]. For the South Sudan Revenue Authority (SSRA), operating as an 11-year-old institution within a challenging economic environment, this operational friction has historically led to low collections, complex logistics, and systemic opportunities for revenue leakage at key trade hubs [3,4]. The historical approach to customs enforcement at primary entry points—such as the Nimule land corridor and Juba International Airport (JIA)—has focused heavily on 100% physical cargo examinations and manual document verification. While intended to prevent evasion, these paper-heavy protocols create massive administrative bottlenecks, prolong cargo dwell times, and increase corruption vectors [5]. This institutional friction raises transaction costs for legitimate businesses, forcing commercial entities to either scale back operations, underreport earnings, or bypass formal channels completely by using informal trading routes [6]. The recent presidential assent to the Treaty Establishing the East African Community (EAC) Act 2026 provides a historic opportunity to reform this legacy system [7]. Although the Act is not yet fully implemented, its enactment establishes the supreme legal mandate to overhaul border operations, align national laws with regional standards, and build investor confidence [8]. This introduction establishes a comprehensive strategy to prepare for full regional integration, utilizing the positive contributions of the EAC Act 2026 as a tool to lower the costs of doing business, deploy automated systems synchronization, and enforce cashless workflows to expand the domestic tax base.

Statement of the Problem

Developing and post-conflict economies face a dual fiscal crisis: they must rapidly increase domestic tax revenues to fund public goods, yet their manual border processes impose high compliance costs on the private sector. In South Sudan, the Nimule One-Stop Border Post consistently generates substantial monthly revenue, but its fiscal potential is limited by manual processing delays and highway security challenges. Concurrently, primary transit corridors and international aviation gates face acute revenue leakage estimated between 24% and 40%, primarily driven by unauthorized, hand-written tax exemptions and unverified manifest workarounds. When the transactional friction of legal cross-border trade becomes too high, businesses face financial losses that distort market behavior. High compliance barriers—such as duplicate physical checks and manual documentation loops—shrink the formal tax base by driving commercial operators into informal parallel markets. This dynamic creates an administrative paradox: heavy, manual compliance controls intended to protect revenue actually decrease voluntary tax compliance, shrink the state's tax base, and accelerate revenue leakage across both land and air trade corridors. Furthermore, these institutional bottlenecks are worsened by non-tariff barriers, such as unauthorized roadblocks and extortion vectors along major sub-Saharan trade routes. These disruptions delay supply chains, increase transport costs, and lower regional trade confidence. Because integrated regional frameworks are still in their early rollout or pre-implementation phases across certain frontier economies, revenue authorities struggle with a lack of automated data visibility, allowing corporate entities to exploit systemic communication gaps between customs valuations and domestic declarations to underreport their profits.

Research Objectives & Questions

Main objective

The primary objective of this research is to evaluate how the deployment of an ecosystem-based economic recovery model—driven strictly by internal fiscal digitalization, automated data synchronization, and technical enforcement tools—can eliminate financial leakages and improve domestic resource mobilization across sub-Saharan economies [9-11].

Specific objectives

a) To evaluate the operational impact of a comprehensive cashless mandate and system-generated invoicing at major border posts on mitigating frontline currency leakage
b) To analyze how system-enforced cryptographic validation blocks and pre-arrival digital exemption frameworks can suppress unauthorized statutory tax waivers at aviation entry points
c) To assess the expected contributions of real-time Customs-to-e-Tax data synchronization (utilizing the Mandatory TIN framework) in identifying corporate turnover underreporting and transit cargo diversion
d) To investigate how utilizing the regional Simplified Trade Regime (STR) threshold influences the formalization rate and tax base capture of small-scale cross-border commerce.

Main research question

How can sub-Saharan economies leverage automated digital tax architectures and internal system synchronization to minimize financial leakages and maximize domestic resource mobilization? [12].

Specific research questions

a) How will the implementation of automated electronic billing and a strict cashless mandate at major border gates eliminate physical currency leakage and secure frontline financial accounts?
b) To what extent can system-enforced validation blocks and cryptographic tokens at aviation gates neutralize manual, ad-hoc tax exemption fraud?
c) In what ways will future real-time database synchronization between customs management engines and domestic e-Tax systems isolate corporate income tax underreporting and transit cargo diversion?
d) What is the expected impact of the regional STR threshold and decentralized Simplified Certificate of Origin (SCO) issuance on expanding the registered tax base?

Significance of The Study

This study provides public sector executives and revenue officials with an empirical blueprint to overhaul archaic border operations and maximize domestic resource mobilization. By demonstrating the direct revenue-capture benefits of automated data pipelines like Customs-to-e-Tax synchronization, the study gives decision-makers the evidence needed to transition from blind physical enforcement to an intelligence-led, risk-based operational model. It offers actionable strategies to convert newly signed regional instruments, like the EAC Act 2026, into field operations that secure the national tax base. For trade, industry, and logistics associations, this research highlights how reducing administrative compliance barriers directly lowers the real cost of doing business across land corridors and aviation hubs. It provides a clear case for implementing regional compliance programs, showing how granting "Green Channel" status and deferred payment options to highly compliant firms reduces terminal dwell costs and increases capital velocity [13]. This helps create a more predictable, transparent, and hospitable investment climate across sub-Saharan Africa. Furthermore, the study sheds light on the economic realities of small-scale cross-border commerce, which represents over 80% of total employment in the region. By evaluating the simplified documentation under regional frameworks, the research advocates for policy measures that protect vulnerable trading groups, particularly women, from border harassment and high formal compliance fees. This paper establishes a comprehensive framework and empirical baseline that future researchers can use to analyze the relationship between trade facilitation and domestic tax base expansion in emerging sub-Saharan markets.

Theoretical Framework & Methodological Approach

This policy intervention is guided by Laffer's Optimum Taxation Theory and the World Customs Organization (WCO) Coordinated Border Management (CBM) Framework. These theories state that lowering trade compliance costs and administrative barriers increases total business activity, expanding the taxable economic base and driving up net tax yields. Conversely, excessive administrative friction acts as an informal tariff that discourages investment and encourages tax evasion [14].

[System Modernization] ➔ [Lower Compliance Costs] ➔ [Formalization of Trade Base] ➔ [Increased Fiscal Yield]

To validate this approach, the SSRA uses a data-driven method that combines cross-border transaction tracking with internal digital audits. The research design uses quantitative transactional auditing to track cargo flows across primary border points via automated single-window portals. This allows the authority to isolate specific institutional bottlenecks, analyze cargo dwell times, and establish clear operational baselines across major tariff lines. Additionally, this methodology utilizes Time-Release Studies (TRS) to mathematically map cargo transit speeds against administrative checkpoints. By collecting transaction logs from the integrated customs system and commercial bank repositories, the SSRA can run comparative revenue reconciliations. This empirical foundation allows the authority to systematically track how reducing border delays and automating processes directly matches increases in voluntary tax declarations and domestic tax base expansion.

Conceptual Framework

The conceptual framework illustrates the relationship between the independent variables (Financial Digitalization tools), the moderating variable (Customs-to-e-Tax Synchronization under the Mandatory TIN data loop), and the dependent variables (Revenue Mobilization metrics) (Figure 1).

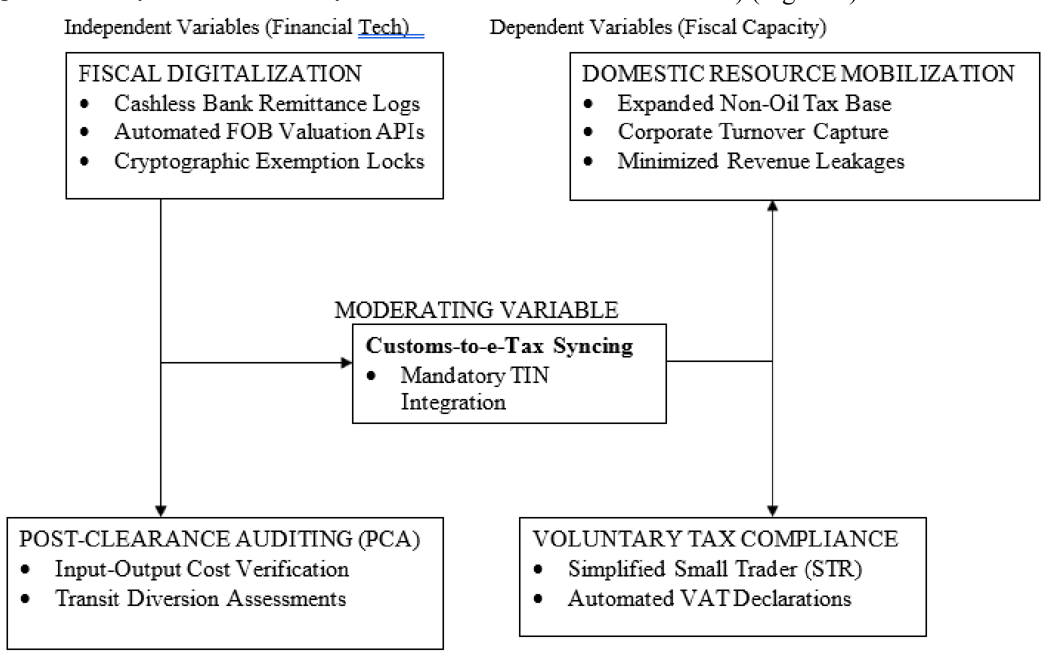

Figure 1: *Conceptual Framework Model.*

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The model posits that the introduction of digital fiscal tech and targeted post-clearance reviews directly optimizes state revenue and improves corporate declaration accuracy. In developing or fragile contexts, these automated systems require an integrated data loop to prevent human discretion and close systemic collection gaps.

The introduction of real-time database syncing across the Mandatory TIN framework serves as the moderating catalyst. By linking border transaction registries with internal income files, the system validates commercial footprints automatically. This configuration gives revenue administrations the institutional power to catch transit cargo diversion, detect turnover underreporting, and transition small-scale commerce into formal compliance.

Core Policy Pillars for Public Action

Pillar 1: Enforcing cashless bank remittances to secure frontline receipts

The complete elimination of physical currency handling at all border entry points is an immediate requirement to secure the revenue collection loop. The institutionalization of a cashless mandate requires all duties, penalties, tariffs, and statutory fees to be issued exclusively through system-generated electronic invoices. This electronic invoicing removes human discretion from financial assessments, preventing manual alteration of receipts and securing the revenue collection loop from the point of entry. Under this pillar, trade operators must deposit assessed liabilities directly into designated revenue repositories at accredited partner commercial banks. No customs official or border guard may accept or handle physical currency. This operational separation between duty assessment and revenue collection minimizes corruption vectors and transfers cash handling responsibilities entirely to the commercial banking sector. To secure this system, real-time financial audit trails must link commercial bank payment logs directly to the central customs clearance release queue. The automated customs software will systematically lock the release mechanism for all cargo until the digital ledger registers a verified payment. This ensures that no consignment can be physically or electronically released without automated validation, creating an unalterable digital paper trail for every transaction.

Pillar 2: Deploying cryptographic exemption locks at aviation entry points

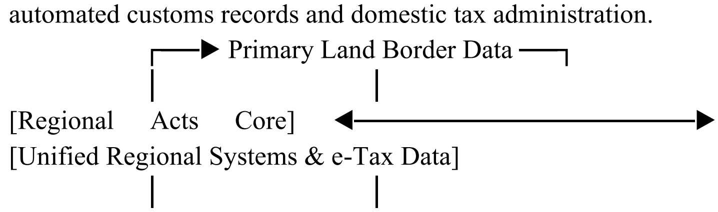
Digitalization emerges as a key growth driver, providing the data tools required to secure highly sensitive transit points. Recent empirical findings confirm that adopting digital architectures in major sub-Saharan economies significantly stimulates industrial activity by stabilizing fiscal management loops. Aviation customs require exceptionally rapid processing due to the time-sensitive nature of air freight, making international airports a priority for automated synchronization. This pillar implements a pre-arrival digital exemption framework that completely bans manual, hand-written, or ad-hoc tax exemption letters at all airport customs gates. All ministerial, statutory, and diplomatic waivers must be uploaded by the issuing ministry into the secure digital customs portal before the aircraft lands. To prevent unauthorized clearing workarounds, the central customs software will deploy automated validation blocks, preventing any clearing agent from processing a tax-exempt entry unless it is authenticated by a verified, system-generated cryptographic token linked to the pre-uploaded ministerial waiver. Finally, the protocol introduces automated air manifest reconciliation by enforcing the E-Permit framework, automatically cross-referencing inbound airline electronic manifests with submitted customs declarations before cargo is offloaded.

Pillar 3: Post-clearance auditing (PCA) and input-output cost verification

Robust digital infrastructure rollouts must be paired with structured, retrospective financial reviews to ensure full compliance across high-volume trade routes [15]. Developing states suffer from acute revenue leakage because physical border gates lack the time to audit complex corporate accounting books during active transit. Shifting detailed valuation and accounting reviews away from congested checkpoints to a dedicated Post-Clearance Audit (PCA) division allows cargo to flow efficiently while protecting the state's fiscal interests. Under this pillar, specialized PCA valuation teams use advanced international coding metrics, such as the EAC Harmonized System (HS) standard, to retrospectively audit corporate transactions. These squads pull production input data from import records and cross-match them against final exported outputs. This empirical input-output verification prevents manufacturing and trading firms from artificially inflating their production expenses to overstate costs and lower their domestic taxable profits, maximizing corporate income tax collection.

Impact Analysis: Anticipated Customs-to-E-Tax Syncing

The core revenue improvement promised by the integrated recovery framework lies in forging a technical bridge between automated customs records and domestic tax administration.



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└──▶ Aviation Customs Data ──────┘

Once the automated data pipeline between the Customs Management Engine and the domestic e-Tax system is activated via the Mandatory Taxpayer Identification Number (TIN) framework, it will contribute to revenue collection through three distinct enforcement mechanisms:

a) Export-to-Turnover Reconciliation: The e-Tax system will automatically match the total Free on Board (FOB) value of an entity's customs export declarations against the Gross Revenue reported on their annual Corporate Income Tax (CIT) returns. This synchronization will eliminate hidden corporate profits by flagging discrepancies between outward commercial volumes and declared domestic turnover.

b) Transit Diversion Detection: By utilizing the tracking networks of the Unified Single Customs Territory (SCT), any shipment declared for export that lacks a certified digital exit confirmation at the border gates will be flagged immediately (Uganda Revenue Authority, 2025). The system will automatically classify these transactions as domestic sales, enabling the revenue authority to retroactively assess the operator for standard domestic Value Added Tax (VAT) and Business Profits Tax plus penalties [16].

c) Input-Output Cost Auditing: Post-Clearance Auditing (PCA) teams will leverage the automated data flow to reconcile imported raw material metrics against final manufactured export volumes. This loop will verify the true Cost of Goods Sold (COGS), preventing multi-national and domestic corporate entities from artificially inflating local operational expenses to lower their domestic taxable profits.

Revenue Formalization via the Simplified Trade Regime (STR)

To maximize revenue in a developing economy, formalizing small-scale, informal cross-border trade is just as critical as monitoring large corporate entities. Informal cross-border trade frequently accounts for a significant portion of regional commerce but remains unrecorded due to complex customs documentation. By preparing the legal groundwork for a localized US $2,000 per consignment threshold at primary border stations, revenue authorities align with regional common market protocols, granting duty-free access to eligible small-scale traders and bringing informal trade into the formal economy.

To eliminate administrative barriers for local agricultural and artisanal producers, frontline customs personnel will be authorized to issue the Simplified Certificate of Origin (SCO) directly at border points. This replaces long, expensive commercial customs documentation with a single, simplified document. This formalization strategy encourages small businesses to register under the national tax database, allowing the authority to track regional trade volumes and transition informal operators into compliance.

Additionally, dedicated Trade Information Desks (TIDs) will be deployed at major entries in collaboration with cross-border trade associations. These specialized information hubs will provide real-time clearance assistance, verify goods against the bilaterally agreed Common List of Qualifying Products, and protect small-scale traders from arbitrary administrative harassment. These centers lower compliance barriers, eliminate informal border friction, and protect vulnerable trading groups, particularly women, while building a data-driven foundation for long-term tax base expansion.

Expected Positive Contributions to the National Economy

The domestication and enforcement of integrated regional frameworks bring substantial fiscal advantages to developing nations, even during pre-implementation phases. First, the domestication of regional treaties provides a predictable legal environment that protects international and regional investors from arbitrary tariff changes. By signaling that a nation is legally committed to a standardized regional customs union, the framework helps attract foreign direct investment into manufacturing and agriculture, expanding the long-term domestic tax base.

Second, preparing the infrastructure for a Unified Single Customs Territory (SCT) will significantly improve revenue collection security [17-19]. By enabling electronic duty collection at the first points of entry—such as maritime coastal ports—revenue authorities can secure revenue before cargo enters transit corridors, minimizing the risk of en-route diversion and smuggling. This pre-arrival collection mechanism is projected to improve customs revenue capture and stabilize national cash flows.

Finalizing system networks accelerates internal automation reforms already underway, providing the institutional support required to enforce strict system compliance, eliminate manual workarounds, and phase out corrupt practices. As these digital frameworks expand, the positive contributions of localized and regional legislative acts will help transform revenue services into modern, transparent authorities. This digital progress ensures the generation of stable funds necessary to cover government expenditures and support national public infrastructure networks.

Policy Recommendations & Strategic Call to Action

To translate this strategic blueprint into public action, executive leadership must adopt this policy document as the official operational manual for all border points. This formal adoption establishes clear institutional accountability and ensures compliance with integrated regional frameworks. Frontline officers will be legally required to execute these automated protocols, replacing legacy, non-compliant habits with standardized practices.

Second, public expenditure management teams must approve targeted capital funding for comprehensive ICT infrastructure upgrades. This funding will secure the hardware, software, and secure APIs needed to run real-time database synchronization between the Customs Management Engine and the Domestic e-Tax System. Without this digital link, revenue authorities cannot run the automated data cross-referencing needed to catch corporate underreporting and transit diversion.

Finally, revenue administrations must coordinate with national security forces to enforce route integrity and launch regional Authorized Economic Operator (AEO) programs. This requires an immediate directive to dismantle all illegal roadblocks along critical transit highways, paired with fast-tracked "Green Channel" clearance privileges for highly compliant trade partners. Lowering compliance costs for secure operators allows states to maximize revenue collection and improve public service delivery.

Conclusion

The fundamental insight of this paper is that revenue optimization and trade facilitation are not mutually exclusive; rather, they are deeply codependent components of a modern fiscal state. For public readers and private sector stakeholders, the message is clear: reducing the cost of doing business is not a concession to commercial interests, but a deliberate mechanism to expand the national tax base. When administrative compliance costs are systematically lowered through digitalization and structured coordination, informal markets lose their economic appeal, prompting private enterprises to voluntarily transition into formal, traceable tax registries. For decision-makers within national revenue authorities and ministries of finance, this paper serves as an urgent call to transition away from reactive, manual enforcement habits. The signing of regional frameworks provides a powerful legal shield to override legacy, paper-based bureaucracies and implement deep structural reforms. The path forward demands an unwavering political commitment to enforce the cashless mandate, automate exemption streams via cryptographic controls, and fully integrate customs logs into the domestic e-Tax framework. Ad-hoc physical interventions must permanently give way to automated, intelligence-led risk management. Ultimately, preparing the institutional groundwork for regional integration before full implementation on the ground allows developing countries to turn a period of economic transition into a strategic fiscal advantage. By utilizing modernizing customs and trade protocols, policy-makers can eliminate systemic corruption vectors and secure transit routes. Executing these pillars will secure the national revenue base, foster long-term supply chain confidence, and generate the domestic revenue needed to fund essential government services and public infrastructure.

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