

Barter 2.0: Leveraging Blockchain and AI to Unlock AfCFTA Trade Potentials.

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INTRODUCTION

Barter systems, widely used during the formation of early commerce, lack sufficient information flows today. The African Continental Free Trade Area (AfCFTA) is Africa's largest free trade initiative. It offers free trade access to 1.3 billion people and is expected to significantly boost intra-African trade. Intra-African trade peaked at 21% in 2008 and dropped to 15% in 2021, largely due to non-tariff barriers. Among Non-Tariff Barriers, only 4.4% of firms are aware of AfCFTA, and only 3% of the firms ship goods abroad. Barter enables digital platforms to trade goods without currency, thereby tackling Non-Tariff Barriers and boosting intra-African trade.

The first barter system dates to 6000 BC, making it the oldest mode of transaction. The Mesopotamia tribes first introduced it, and later, the Phoenicians embraced it as a form of trading. They bartered goods to diverse people located in various cities across the Nile and beyond. Barter is a commodity exchange that does not require money. One trades goods in return for remuneration or settles the transaction later on. Counter trade distinguishes between barter-based and non-monetary trade. At these two junctions, settlement units, value exchange, collateral, and risk transfer come into play. In counter trade, two transactions are independently fulfilled, while barter-based trade relies on a single transaction. With barter, both sides can trade their valued goods without the need for money (Mihajlov et al., 2019) ; (Tedeschi et al., 2018).

In simple terms, this paper defines Barter 2.0 as a multilateral, rules-based trade settlement system that uses tokenised trade credits (not currency), Blockchain-based ledgers for transparency and auditability, AI-driven matching, pricing, and risk management to settle trade obligations in goods and services across AfCFTA members. It is not cryptocurrency, not legal tender, and not a substitute for central bank money.

This paper investigates how Barter 2.0 allows participating AfCFTA countries to reap substantial trade benefits even with inefficient customs clearance and standards. Despite the continent's vast trade potentials, only 18% of African trade occurs within the region. Barter 2.0 can facilitate greater trade among AfCFTA members—particularly for products in which country-level trade already exists—by underpinning trade transparency, matching supply with demand, automating compliance checks, and ensuring equitable cross-border transactions (Mihajlov et al., 2019).

Background: AfCFTA and the Imperative for Enhanced Trade Facilitation

The African Continental Free Trade Area (AfCFTA)—the world's largest trade agreement—promises to unleash significant trade potentials across the continent. Trade facilitation emerges as a critical enabler of AfCFTA, as borders remain hurdles to intra-African trade. Current impediments include inefficient customs processes, inadequate transport logistics, pervasive informality, lack of data-driven trade information, and a sustained increase in non-tariff measures. The negative impact of non-tariff measures on intra-African trade is estimated between \$15 billion and \$30 billion annually. These systemic barriers constrain small and medium enterprises, which account for 80 percent of jobs, 70 percent of industrial output, and 70 percent of total

economic activity. Despite strong economic ties built on shared history, cultural affinities, similar purchasing power, and geographic proximity, intra-African trade remains below 20 percent of total trade.

Barter 2.0—an adaptation of barter leveraging blockchain and artificial intelligence (AI)—has the potential to unlock unprecedented trade facilitation gains under AfCFTA (Mihajlov et al., 2019). Digitalized settlement, trade matching, risk assessment, and regulatory compliance integrated into Barter 2.0 can bolster intra-African trade and support broader economic transformation. The approach aligns with the United Nations Economic Commission for Africa Trade Facilitation and AfCFTA Implementation Acceleration Programme, providing a phased, agile pathway to address identified trade facilitation priorities.

Continuous harmonization of trade and transport documents remains imperative. A comprehensive AfCFTA Document Harmonization Initiative—centred on a digital single window architecture—could accelerate compliance by piloting systematic alignment of transport, sanitary and phytosanitary, and customs documents. Harmonized administrative and operational trade datasets, types, structures, regulations, procedures, processes, and standards enhance interoperability across digital trade platforms and trade facilitation instruments, thus improving information exchange and support for regulatory and operational decision-making by barrier-reduction initiatives.

The Barter 2.0: Conceptual issues

Blockchain technologies have gained attention as a means to provide greater transparency and efficiency in trade. A blockchain is a distributed database consisting of records or “blocks” linked together in a chain and protected by cryptographic signatures. Blockchain transactions enjoy a high degree of trustworthiness because they are immutable and secured through a distributed consensus process. The primary trade-related applications of blockchain are related to providing information on transaction history (transparency) and Monitoring compliance with legal, regulatory and commercial obligations (trade facilitation) (Tedeschi et al., 2018).

Barter 2.0 distinguishes itself from existing trade facilitation concepts through its integration of artificial intelligence (AI). Virtual barter exchanges exist today in which traders can advertise goods and services sought and on offer. The challenge is matching trader requirements efficiently. AI approaches can help to identify and provide timely, optimal matches. Similarly, traders seeking to minimize trade settlement risk can derive a quantitative measure of risk based on the nature of the goods or services transacted. This trade settlement risk assessment is more effective than conventional methods when markets lack transparency, and AI can also assist in determining the legal, regulatory and counterparty risks associated with prospective transactions (Zheng et al., 2019).

Since African Continental Free Trade Area (AfCFTA) partner states differ greatly in size and level of economic development, interoperability and standardization are crucial. The Barter 2.0 architecture facilitates the integration of the trade facilitation aspects deployed across AfCFTA partner states and provides a minimum specification of capabilities to support Barter 2.0 trade facilitation.

- **Blockchain Fundamentals for Trade Transparency and Settlement**

The proliferation of trade instruments and instruments through the evolution of market economies demand adherence to, and full compliance with, trade regulations and standards. Such comprehensive measures indeed constitute major impediments to establishing barter trade systems based on various traded products, commodities and other instruments. Several solutions, processes and systems, nevertheless, could contribute towards improving the support systems and thereby facilitating access to certain traded products (Mihajlov et al., 2019). The following explores blockchain models that underpin technologically advanced solutions to enhance trade facilitation through barter.

A public blockchain network consisting of appropriate stakeholders sharing confidential and sensitive information could, for example, accommodate trade transactions involving disparate partners, especially those executing high-value transactions from large companies requiring extensive dimensional and compliance

information. In the absence of reliable digitized commercial documents and support material across the various trade flows, sensitive data remain inaccessible; whereas trusted partners could simultaneously satisfy diverse regulatory assurance of verification, origin and certification from diverse authorities. Even where the trade relates to exchanges of a single commodity, enabling dispatches at such varying constellations remains vital. Such an operating blockchain structure likewise enables scanning of, and access to, international documentation irrespective of the administrative regime governing local activity. A further option is establishment of a verification and compliance layer on top of a commercially beneficial or barter trade, rendering complemented support documents and data available to both buyers and sellers, even on an open proprietary basis.

Moreover, as an adjunct to the above, provision occurs for access to compliance and or duty status of any traded partner with linked solutions sufficiently transparent to affirm the absence of duty, trade control or other regulatory hurdle; consequently facilitating potential barter links and integration in extensive global trade flows. A secondary problem arises associated with assurance and verification of trade opportunities, buyers and suppliers; an ongoing international dialogue spans approaches to such issues as efficient digital trade paperwork, visibility and security of commercial documentation, commodity verification and permissible cargo accompaniment.

- **AI-Driven Trade Matching, Risk Assessment, and Compliance**

The architecture of Barter 2.0 is agnostic to underlying technologies. Similarly, the trade matching and evaluation subsystem could operate without artificial intelligence (AI). Applications can be developed that perform these functions without employing techniques that synthesize knowledge and experience into executable programs. However, using AI potentially allows for greater flexibility and operational relevance, especially in the context of real-time trade matching. Provided, of course, that sufficient training data and infrastructure are available for developing a functioning application.

A comprehensive process for real-time trade matching and risk assessment focuses on three areas of AI application: trade matching supported by experimentation and risk assessment of trades proposed by user-initiated trade engagement undertaken through simple instructions. When demand and supply requests are produced in time-sensitive contexts, user interfaces assist users in specifying trade preferences across these dimensions promptly. These preferences are subsequently referenced in trade engagements and assessments of proposed trades, even if no applied resources can be readily identified in subsequent matched pairs. Input from supporting parties – such as commercial banks, payment service providers, insurance providers, and risk management specialists – can provide additional support.

- **Interoperability and Standardization across AfCFTA Partners**

Interoperability facilitates the use of a particular technology across systems or platforms, while standardization ensures uniformity across various technology components within a system. Interoperability and standardization are critically absent across AfCFTA member states. Consequently, AfCFTA member states employ multiple trade documents exhibiting varying content, structures, and standards (Mihajlov et al., 2019). Neither the Web Content Accessibility Guidelines (WCAG) nor the International Organization for Standardization (ISO) standards or the International Public Sector Accounting Standards (IPSAS) regulations are adopted or implemented by AfCFTA member states. Furthermore, no established Standard Operating Procedures (SOPs) are documented across various technological components supporting each trade document throughout the trade life cycle.

Architectural Framework for Barter 2.0

Barter 2.0 enables asset-exchange matchmaking between trading parties through artificial intelligence and machine-learning algorithms. A trade-off self-assessment with risk evaluation facilitates the identification of compatible trade partners or commodity interlinkages. Based on a distributed public blockchain ledger with shared visibility, trade transactions are secured through time-stamped decentralised electronic signatures and

simplified transparent bulk verification governed by a smart contract coupled with an underlying harmonised legal framework (Tedeschi et al., 2018).

Robust governance structures leverage the involvement of public authorities or quasi-public institutions, promoting the required interoperability between the public sector and the private sector to ensure collective trust. Clear rules and protocols guarantee transparency, minimise risks, and encourage the participation of local authorities and micro, small, and medium enterprises. Data sovereignty and control by the authority formally establishing the exchange or entity underwriting the trade-off mechanism are assured through the combination of blockchain technology and artificial intelligence. Complementary role for national watched-trade frameworks and existing bilateral revenue or investment treaties concessional-financing initiatives between two AfCFTA countries and trusted third parties.

- **Stakeholder Roles and Governance**

An enhanced solution sustainable within the AfCFTA intervention logic, building on robust theoretical underpinnings and responding to increasing interest, is requisite. Integrating these considerations, Barter 2.0 establishes an architecture to leverage blockchain and AI for trade facilitation that respects reciprocal exchange, facilitates intermediation across entire trading networks within and beyond the AfCFTA zone, and encompasses both exchanges of goods and non-physical services (Mihajlov et al., 2019).

Barter 2.0 promotes large-scale, frictionless, real-time trading even among AfCFTA participants where no bilateral needs are visible; the effort concerned harnessing pre-negotiation goods to close mutual obligations with cash-strapped entities across the continent; and, beyond active exchanges with a single counterpart, spreads network access. Immutable smart contracts that ensure pre-set conditionality on both delivery and acceptance of goods, underpin instant resolution and assurance of exchanges. Barter 2.0 securely tokenises all assets, formally under equation routable by integers, digitally trading balances for liquidity access without exposing the underlying.

- **Data Privacy, Security, and Compliance**

The proposed Barter 2.0 framework leverages blockchain and artificial intelligence to facilitate cross-border intra-Africa trade. Given stakeholder diversity, appropriate governance models are essential for effective multi-party collaboration. To ensure inclusive input, a three-tier stakeholder categorization—national governmental organizations, trade facilitation intermediaries, and international non-governmental organizations or organizations operating in Africa—was established. These categories help identify and understand stakeholder needs, which inform stakeholder-specific applicability or usefulness questions. Identifying core stakeholder roles further clarifies governance activities and responsibilities required to leverage the Barter 2.0 opportunity underlying the AfCFTA.

The AfCFTA comprises 55 African nations. Coordinating facilitating and supporting Barter 2.0 activities presents a considerable challenge given stakeholder diversity. Achieving compliance with trade regulations during cross-border transactions requires accurate and timely submission of a range of trade documents. Though compliance checklist generators can simplify regulatory requirements for specific bilateral trade scenarios, tracking dynamic obligations at the continental level remains complicated. Systematic articulation of countries' AfCFTA-related modalities, expressed in terms of the Barter 2.0 taxonomy, supports a more effective monitoring, communication, and enforcement strategy at the continental scale. The entire AfCFTA ecosystem continues to evolve, so the articulation specification remains an ongoing task.

Governments are historically disinterested in regulating barter transactions and data custodianship. Enhanced privacy measures can further counter reluctance to provide input and facilitate other registered payments on private data. Data brokers frequently permit the sale of data derived from raw input without disclosing crucial safeguarding requirements. Detailed inspection of the Barter 2.0 platform architecture verifies the feasibility of retaining control over raw data while generating tradeable data assets from auxiliary activities or permitted queries on a continuous basis without actual data exchange during compliance checks. This enables the use of a conforming cross-border Barter 2.0 platform or intermediary services capable of facilitating AfCFTA

counterparties while limiting exposure or preventing spoilage of private data associated with raw data from other countries.

- **Smart Contracts and Automated settlement Mechanisms**

Unrestricted trade stands as a pivotal accelerator for economic growth. Yet, a staggering 90% of Africa's trade remains unprocessed (Lesia, 2022), hindering the desired progression of African countries and the continental economy. Barter 2.0 facilitates trade of unprocessed goods by integrating artificial intelligence (AI) with Blockchain in the African Continental Free Trade Area (AfCFTA) framework. This integration enhances compliance, matching, and risk assessment; fosters trade among non-resource-rich countries; and promotes multi-player values, food security, and supplier diversity. The AI-driven solution awaits implementation. Race for the Government of France's International Framework for the Marrakesh Declaration and the Bertelsmann Foundation's global ecosystem collaboration for prioritizing digital identity verification for all AfCFTA stakeholders is on. By embracing Barter 2.0, Africa secures a high-level tool for trade facilitation that unlocks huge potential for AfCFTA.

Barter 2.0 implements smart contracts for contracts or purchase orders and settlement mechanisms for arranging counter-value goods in a digital currency or other assets during cross-border trade. Based on a common understanding of stakeholder roles, data privacy, security, and compliance regulations, automated AI programs initiate compliance checks for sanction regulations. Restrictions on transferability prevent mismatch of declared data. Counter-value goods tracking trace ownership, phase, and destination update via the blockchain, and support various settlements and asset classes. Global solutions for producing and matching billions of tokens exist. Flexibility is vital; trade facilitation value derives from assistance in adhering to AfCFTA terms for untapped supply instead of guarantees on a specific produced quantity. The AI-driven solution for flexibility is demonstrated via an uphill access policy and a high-speed formula based on trade stage, volume, and distance (Heidari et al., 2024).

Smart contracts are a key component of blockchain technology, enabling automated and self-executing agreements. Smart contracts reduce uncertainty and complexity in value exchange and can enhance security and privacy-preserving mechanisms. Their applications span various sectors, including finance, smart cities, and the AEC industry. Challenges include ensuring interoperability between different blockchain systems. Implementing various algorithmic versions of the Income Sharing principle between companies in a supply chain can improve supply chain management strategy.

- **Tokenization, Digital Assets, and Liquidity Management**

Tokenizing ontological assets can enhance liquidity management in Barter 2.0 investments. Liquidities, recognized as serviceable towards Finance 4.0 goals, cover the ratio of serviceable ontological Digital Twin investments to all ontological investments across local and AfCFTA settings. These investments, paralleling the spectrum of tradeables, encompass community-loan financing, product & service development, trade facilitation, onboarding, capacity development, lending, and trading from attendees to AfCFTA partners. Trade facilitation remains paramount due to its far-reaching impact across all Tradeables. In traded communities, developing and implementing tools that digitize, chainify, and tokenize transactions through available factures attached with Liquidity Tokens can facilitate liquidity-generation along local and contract spaces. Such initiatives are intricately tied to timely and ongoing developments in the Barter 2.0 framework (Mihajlov et al., 2019).

Use Cases and Economic Implications

The Barter 2.0 framework enables digitalized trade facilitation solutions that offer higher efficiency gains in non-resource-rich economies. It prioritizes agriculture, manufacturing, and cross-border services that address food security and require diverse suppliers. Digitalized trade facilitation will attract investment, ease mobility of businesses and labour, and catalyse regional value chains that are resilient to external shocks. Agricultural commodity and manufactured goods trade among AfCFTA countries plus the broad services sector could increase by US\$27 billion annually (Mihajlov et al., 2019).

Enhancing transparency, settlement speed, counterparty risk mitigation, and compliance relaxation enables resource-received and cash-paid trade. Stakeholders can progressively adopt Barter 2.0, starting with on-chain cash. Those with established resource-based currencies can similarly incorporate additional traded commodity and cross-border service elements such as goods provided in exchange for resource-received commodities. Barter 2.0 optimises liquidity through tokenization and asset-matching algorithms, reducing price-discovery cycles and establishing fair-pricing signals across undervalued resource economies.

- **Trade Facilitation in Non-Resource-Rich Economies**

Barter is widely regarded as critical to the development of trust and cooperation in the exchange of goods (Mihajlov et al., 2019) through structured rules and aims. This trade mechanism is intensified for two economies seeking a zero-deficit balance in bilateral trade due to scarce traded goods. A barter conception in such economies can be viewed as a structure providing individual trade-matching goals based on local economies and desires consolidated into joint, regional objectives. Blockchain technologies, further enhanced by artificial intelligence (AI), enable a novel Barter 2.0 concept facilitating the sharing of important market demand and supplier knowledge and constraints while retaining crucial local information and ensuring foremost confidentiality in articulating local trading interests. While Barter 1.0 provided insight into local, market-driven trade checks of goods regarded as superfluous or recyclable, Barter 2.0 matches common AfCFTA-consideration consolidated goals.

- **Agriculture, Manufacturing, and Cross-Border Services**

Research indicates that greater trade facilitation under the AfCFTA could unlock significant economic benefits (Lemeilleur et al., 2019). Non-resource-rich AfCFTA economies with strengthened trade facilitation provisions on average stand to gain even more in terms of GDP-corrected welfare than resource-rich counterparts. Countries can maximize these welfare gains through transnational cooperation and by sharing responsibility for supplementary trade facilitation investments.

Most countries in Africa, like the rest of the world, have adopted new and stricter Open Trade Agreements that generally prevent the movement of goods unless border tariffs or levies have been paid (Kamilaris et al., 2018). Trade restrictions such as import quotas, embargoes, and import licenses still limit internal supply. The automatic renewal of such quotas, outdated and inefficient levies, and other factors constrain Africa–Europe trade relations, as do transport and supply bottlenecks and high clearing and quayside dues. Nevertheless, enabling intra-African trade may also have an indirect effect on trade with Europe.

- **Food Security and Supplier Diversity**

The value of agriculture, food manufacturing, and logistics as primary input suppliers has historically remained low in trade for several emerging economies in Africa, despite sizable trade activity with AfCFTA partner countries. This highlights the importance of cross-border agribusinesses for both supplier diversification as well as food security and supply within the AfCFTA.

Agricultural production remains highly vulnerable to climate change and external shocks, and countries with high food import dependency expose themselves to elevated risk. Addressing the food security challenge through intra-AfCFTA diversification across suppliers rather than commodities opens options for countries to focus on commodity-specific production in which they have a relative advantage as a first step toward specialization, and thereafter aggregate diversification on the selected commodities. The higher frequency of non-farm income indicates the opportunity in agricultural logistics—including preservation, processing, and food delivery services—to augment trade also within agri-logistics and add value during economic upturns when commodity prices surge. Given limited resources in the region and slow adoption of blockchain and automated processes (Lemeilleur et al., 2019), AfCFTA member states require collaborative frameworks that efficiently match trusted suppliers with available opportunities, evaluate the risk profiles of products supplied, and automatically facilitate contract requirements with regulated monitoring of compliance.

Challenges, Risks, and Mitigation Strategies

Barter 2.0 enables seamless cross-border trade via an openly accessible network that matches supply to

demand based on granular trade data and profiles. While its architecture fosters decentralized governance and maximizes participation, it also raises several technical and ethical challenges for adoption. Mitigating these challenges by leveraging collaboration, experimentation, and modularity across sociotechnical dimensions is critical to realising the AfCFTA vision.

Implementing Barter 2.0 within the AfCFTA region entails addressing three sets of challenges: technical and interoperability risks, legal and regulatory barriers, and ethical and inclusion considerations. These challenges may hinder scaling, integration, and alignment with policy frameworks. Nevertheless, upfront engagement with these issues through high-level dialogue and coordinated systemic responses mitigates risks and accelerates progress (Ioannou & Demirel, 2022).

- **Technical and Interoperability Risks**

Blockchain-based trade facilitation solutions bring to the fore multiple interoperability and standardization challenges. Various existing standards, models, and protocols relevant to different segments of trade facilitation have emerged, exhibiting important differences in terms of scope, focus, and granularity. Protocols such as BiDAF and UN/CEFACT Core Component Technical Specification address the basic of trade facilitation data harmonization and governs the “what” of data and information to be exchanged at selected processes, while UN/CEFACT, W3C, OASIS and many others tackle the syntax styles and languages associated with trade facilitation messages, governing the “how” of data and information to be exchanged along selected processes. It is therefore important to see how these various challenge are collectively addressed so that blockchain-based trade facilitation solutions can support countries and stakeholders on their way to trade digitalization (Mihajlov et al., 2019).

- **Legal and Regulatory Barriers**

Legal uncertainty, restrictive regulatory frameworks, and a high burden of compliance present significant obstacles to trade facilitation in Africa. Many governments on the continent have already started making investments in a wide range of initiatives to address these challenges. Important examples include deployment of blockchain-enabled single windows or trade registries (Mihajlov et al., 2019). The AfCFTA agreement emphasises compliance with various international instruments dealing with legal and regulatory barriers to trade.

Many African economies have adopted or are in the process of adopting law reform programmes to harmonise their national legal frameworks with prevailing regional and international standards. Accordingly, governments that have signed the AfCFTA agreement are expected to take additional steps in this direction. Although such measures may seem unrelated to trade facilitation, a direct link exists. Convergence of transaction costs in international trade usually requires symmetry or convergence in compliance with domestic rules and regulations.

- **Ethical and Inclusion Considerations**

AfCFTA’s expected trade gains could heighten existing imbalances among its member countries. To tackle both trade and socio-economic disparities, Barter 2.0 incorporates ethical and inclusion considerations into its design and implementation. Intangible assets and marginalised communities have a key role to play in the future economy, and a balanced approach that upholds equity, gender, and environmental principles must be promoted.

As AfCFTA’s flagship project, Barter 2.0 aims to enhance intra-African trade by facilitating transactions between countries with limited cash liquidity in the early stages of implementation. However, Barter 2.0 must also foster equitable participation and overcome both ethical and practical hurdles. When resource-rich countries engage in commodity production, upstream value creation is confined to mining, leaving downstream outputs trapped at the primary goods stage. The technology’s marginal computing requirements

render it accessible in low-bandwidth areas, provided a basic data infrastructure exists. Use of mobile and web apps lowers operating costs and enables non-digital-savvy participants to engage simultaneously via a voice interface.

Disparities across and within AfCFTA member states have intensified since the COVID-19 pandemic and geopolitical tensions. The AfCFTA phase-2 protocol on investment remains elusive, even though 55% of intra-African direct investment goes to resource-rich nations (Kohnert, 2019). Hence, commodity trade still fuels the majority of Africa's cross-border exchange. The existence of formal barriers and informal opportunity costs hampers trade even among neighbouring countries. Agent-based virtual barter proposals have surfaced, but effective deliberation requires a compliant offer. Many AfCFTA members remain crippled by an informal economy exceeding 40% and global public goods provision, which is undermined by barriers to stakeholder participation.

Uneven distribution of trade advantages is a corollary of unequal bargaining power and transaction costs (Gwagwa et al., 2022). Obtaining large-scale project financing and education capacity for artificial intelligence and blockchain programming remains elusive for small debtors and Afrocentric institutions. Transparency, traceability, and predictability for illicit activities are already available for cryptocurrencies, but they do not suffice for onboarding large projects and comply with the progressive development agenda. Thus, utilising existing digital, mobile, and virtual goods remains strategic.

Implementation Roadmap for AfCFTA Stakeholders

To realize Barter 2.0, national and regional authorities, business organizations, private sector actors, financial service providers, and platform providers should take coordinated steps to establish pilot programs and roll out the approach in phases. The initial focus should be on cross-border trade in agricultural products, manufactured goods, and related services between non-resource-rich AfCFTA members lacking direct access to foreign reserves and where, owing to the AfCFTA protocol, trade restrictions on these products remain legally in place. Relevant activities include training and awareness-raising campaigns, seminars and workshops, and knowledge transfer and capacity-building activities.

Barter 2.0 could support AfCFTA trade initiatives by providing easy, seamless, and safe mechanisms for trade matching, trade facilitation, and support compliance with the AfCFTA. It could ensure proper visibility of all transactions on the blockchain for accurate tracking of accomplishments and disbursements. Furthermore, the structured covering of shortage of supplies in particular countries conducted in partnership with digital platform enterprises supports local agriculture, manufacturing, or export processing sectors to enhance food security and supplier diversification while simultaneously advancing trade eligibility for AfCFTA or similar agreements for cross-border supplies. (Mihajlov et al., 2019)

• Pilot Programs and Phased Rollout

The Barter 2.0 concept, though inherently risky, can feasibly pilot with some attributes within a single sector or domain among a limited group of trade partners. Since trade facilitation is predominantly non-discriminatory, a phased rollout across all themes and borders is advisable, complemented by private-sector, donor, and bilateral support for early-stage development. Stakeholders should investigate potential gains in domains previously impeded by liquidity constraints. Such territories should be digitally and technically equipped for participation and trade growth. Initial projects could focus on facilitating digital services within specialist or niche sub-sectors.

The simplicity of development offers scope for stakeholders on AfCFTA's webinars. Capacity transfer for digital literacy and business consideration formulation—inclusive of trade requirements and legal considerations for African counterparts—is achievable with private industry. For example, the limitation of lower liquidity in non-resource-rich economies bounds trade potential—priority preparation and discussion could yield trades previously unconsidered or limited to greater liquidity allocated there.

- **Capacity Building and Knowledge Transfer**

Facilitating the rollout of Barter 2.0 under the AfCFTA calls for institutional capacities that complement the technical architecture. Stakeholders in the various AfCFTA partner countries and regions must possess the skills required to design, operate, and maintain the Barter 2.0 digital ecosystem. Various levels of capacity building and knowledge transfer are therefore needed, directed at different parts of the ecosystem, including (1) the regional and continental digital infrastructure, (2) the Barter 2.0 architectural framework across a critical mass of partner AfCFTA countries, and (3) the broader Barter 2.0 ecosystem.

The digital Barter 2.0 ecosystem requires administrative capacity at both the national level and across AfCFTA partner countries. Pilot projects can help to develop and validate the necessary technical capacities in both upstream and downstream parts of the ecosystem. In addition to these technical aspects, private-sector activities should be complemented by training and awareness-raising initiatives among companies and other stakeholders involved in cross-border trade, especially SMEs. Private-sector participation in specific Barter 2.0 initiatives will contribute towards building the necessary local skills, while broader knowledge-transfer initiatives will help to ensure that an adequate number of people are equipped to take full advantage of the opportunities presented by the digital environment across AfCFTA partner countries.

Addressing these capacity-development needs may require dedicated funding. A number of multilateral and bilateral funding agencies already support trade-facilitation and digitalization initiatives at different levels and in different AfCFTA partner countries. These institutions generally view the entrepreneurial spirit of the private sector as the engine of growth and therefore support projects and initiatives initiated by the private sector. Funding for the establishment of the digital Barter 2.0 environment will therefore require collaboration between the public and the private sectors at all levels.

- **Funding, Partnerships, and Public-Private Collaboration**

The funding of Barter 2.0's deployment will come from diverse sources. Public donors and foundations may be interested in financing the development of the underlying platforms. For instance, the digitization of the logistics sector can help resolve the move to digitization and tackle the persistent continent-wide logistics challenges observed over the past decades while giving birth to a new service export sector. Lack of proper digitization has been a major bottleneck for trade for a long time. For any trade facilitation efforts to succeed, there must be clear progress on logistics. However, the absence of cost-efficient broadband and cloud infrastructure has basically meant that the supply in this domain has basically been close to absent. By also acting as an anchor demand, these pilot programs can help kick-start some of these domains, particularly those that are lagging in terms of cloud-computing and broadband-digital infrastructure.

Public-private partnerships are needed to help build capacity and expertise in training AfCFTA-facilitated pilots, supporting training programs, and leveraging contributions from private business. Acknowledging the above-mentioned short-term liquidity challenges, preferences of banks, and low credit ratings of many countries, creating a facility to help address both short- to medium-term liquidity constraints as well as their poor credit ratings would be critical as AfCFTA moves fresh into the implementation phase thereby catalyzing trade across borders.

Evaluation Metrics and Impact Assessment

Monitoring the result and progress of Barter 2.0 is fundamental to assess its efficacy in enhancing trade facilitation under the AfCFTA. Evaluation can deploy multiple metrics gauges along the trade value chain—from pre-arrival, through arrival, to post-importation—which can be adapted from recognized standards (Higgins & Rojas-Romagosa, 2016) to the Barter 2.0 framework. (Safuan, 2017). A pre-arrival gauge assesses the information and documents required to originate, conclude, and trade a transaction. The arrival gauge measures the time elapsed between the arrival of the goods in the destination country and the commencement of clearance. Finally, a post-importation gauge counts the total days required to obtain the trade-related information and requisite performance to close transaction items.

AfCFTA states can further integrate these fundamental metrics into an impact assessment methodology based on the multi-layer resource-based view (MRBV) model (A.P.G. Berg, Y. B. Huang, & H. C. Hsu, 2017). The MRBV defines three continuum layers for a good assessment of trade facilitation benefits: policy & regulation; infrastructure (inclusive of ICT)—the broadest; and procedures, which governs the practices supporting the aforementioned two layers. The methodology enables timely identifying those elements posing hiccups in trade facilitation and triggering changes along the capacity to abide by the AfCFTA.

Policy Implications and Recommendations

Based on the AfCFTA Protocol on Trade in Goods, modern trade facilitation has become a crucial component of global trade. Low trade facilitation scores continue to hinder intra-Africa trade (Misbau Rabi, 2018). While digital trading systems abound, there is a need to develop African-centric digital trading ecosystems for deepening intra-Africa trade under the AfCFTA.

Integrating blockchain and artificial intelligence into a proposed Barter 2.0 trade ecosystem can overcome persistent, costly non-tariff barriers to intra-Africa trade and significantly bolster trade volumes. Enhanced use of barter can realize substantial trade facilitation gains even in non-resource-rich economies. The Barter 2.0 trade ecosystem can facilitate intra-Africa trade in agricultural commodities, manufactured goods, and cross-border services while contributing to food security and supplier diversity. Central to Barter 2.0 are blockchain and artificial intelligence. Blockchain enhances transparency and attests to goods' origin and movement, provides real-time record-keeping, fosters confidence among multiple counterparties, and supports trusted verification schemes. Artificial intelligence improves trade matching and facilitates risk assessment and compliance through advanced analytics of structured and unstructured data from diverse sources—trade—government and industry databases, social media, contracts, invoices, transport documentation, and historical trade patterns.

AfCFTA member states have the opportunity to leverage an innovative Barter 2.0 trade ecosystem—an Afrocentric, sophisticated, digitalized trading platform that immerses counterparties in real-time trade proposals. By mitigating the impact of high trade costs and long supply chains, Barter 2.0 can deepen intra-Africa trade, stimulate export diversification and industrialization, and promote food security and supplier diversity across the continent.

CONCLUSION

The findings presented support AfCFTA's objectives of enhancing intra-African trade and participation in global value chains. They address critical limitations of trade facilitation measures within the agreement, complementing ongoing national and regional digitization initiatives to improve compliance with facilitation measures. The analysis further emphasizes the need for collaboration between the private sector, regional economic communities, and the African Union to realize this potential. The phased roll-out, beginning with cross-border trade in non-energy minerals between resource-poor economies, enhances chances of success by focusing on sectors with the greatest AfCFTA trade growth and linking broad private-sector constituencies to the initiative.

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