Reorienting Global Value Chains under AfCFTA: The Role of SEZs and Emerging Technologies in Boosting Value-Added Trade and Firm Upgrading

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Abstract: This study examines how Special Economic Zones (SEZs) and cutting-edge technologies can reposition Africa in global value chains (GVCs) under the African Continental Free Trade Area (AfCFTA) (Mondaq, 2023). Africa's intra-continental trade remains low (≈15% of total exports), and its GVC participation (≈5%) and export value-added (≈14%) are far below other regions. SEZs - over 200 currently active in Africa - offer a policy vehicle to boost manufacturing and export diversification. We develop a conceptual framework combining Global Value Chain theory, Institutional theory, and Innovation Diffusion theory to analyze firm upgrading, trade composition, and technology adoption in SEZs. Drawing on a mixed-methods approach (trade data analysis, policy document review, and case studies of Rwanda (Kigali Innovation City), Nigeria, Kenya, and Ethiopia), we find that well-designed SEZs **can** enable capability upgrading (especially via skill development and local linkages), modestly shift exports toward higher-value manufactures, and attract investment if backed by strong institutions. However, many SEZs remain "enclaves" with limited spillovers. Emerging technologies (blockchain, AI, IoT, 5G, additive manufacturing) show promise for enhancing SEZ operations by improving supply-chain transparency, productivity, and efficiency, but their adoption is hampered by infrastructure gaps, high costs, and skills shortages. We conclude with tiered policy recommendations (zone-level, national, and AfCFTA-level) to foster tech-enabled SEZs that promote value addition and regional integration, and outline areas for future research and long-run trends (e.g. digital GVC platforms and green value chains).

Keywords: Special Economic Zones; Global Value Chains; AfCFTA; Africa manufacturing; intra-African trade; emerging technologies; Kigali Innovation City; value-added exports; firm upgrading

I. Introduction

The African Continental Free Trade Area (AfCFTA), launched on January 1, 2021, created a unified market of ~1.3 billion people and ~$3.4 trillion GDP (Mondaq, 2023) It is designed to eliminate tariffs on 90% of goods and liberalize services, thereby deepening regional integration (Mondaq, 2023). The agreement explicitly targets structural transformation: it "encourages African countries to diversify their economies and reduce reliance on traditional commodities" by expanding manufacturing and value-added industries. If fully implemented, model-based projections show AfCFTA could raise real African incomes by 7% ($450 billion) and boost total exports by ~29% relative to baseline, with intra-African exports soaring by +81% by 2035 (Mondaq, 2023). These potential gains are enormous, but they will materialize only if Africa can reorient its economies toward higher-value production and more diversified exports.

Currently, African trade is still highly export-oriented toward raw materials and low-technology goods. Intra-continental exports accounted for only ~15-17% of Africa's total trade in 2022 (PACCI, 2024), far below intra-regional shares in other continents (e.g. ~68% for Europe [Mondaq, 2023]). Moreover, studies find that Africa's participation in Global Value Chains (GVCs) is very low: for example, Africa's GVC participation rate was only ~4.8% in 2019 (versus ~9.5% in South Asia), and the value-added share of African exports was only ~14% (versus ~30% in East/Southeast Asia). As one AfDB report notes, *"participation in GVCs has become the new paradigm for economic development*" (Malah, 2023), driving job creation and growth. Yet African output largely enters GVCs only as raw inputs; manufactured exports remain modest (UNIDO, 2020; Malah, 2023). Unlocking AfCFTA's benefits thus requires higher value addition - that is, increasing the share of manufactured and processed goods in exports and upgrading local firms into more advanced activities.

Special Economic Zones (SEZs) have been a prominent industrial policy instrument in Africa, aimed at attracting investment, generating exports, and fostering industrialization. An African Development Bank survey counted over 200 operational SEZs in Africa (and dozens more under development) by 2021 (White & Case, 2024). SEZs typically offer incentives (tax holidays, subsidies), streamlined regulations (one-stop centers), and infrastructure support to encourage manufacturers and exporters. In theory, a successful SEZ can integrate local firms into GVCs, facilitate technology transfer, and drive productivity and skill upgrading. Indeed, one World Bank analysis emphasizes that SEZs should "build on local comparative advantages" and link domestic suppliers into zone firms, creating backward and forward linkages that maximize spillovers (technology transfer, skills, productivity) (Zeng, 2021). However, the evidence so far on African SEZs is mixed. Many zones have underperformed relative to East Asian benchmarks; common problems include poor infrastructure, weak institutional linkages, and insufficient local content (Zeng, 2021; Hodder, 2024).

For example, zones often operate as isolated enclaves disconnected from the domestic economy (Zeng, 2021). As a result, African SEZs have had limited success in dramatically changing export composition or upgrading domestic firms on their own.

At the same time, the rise of emerging technologies offers new opportunities to upgrade production. Digital and manufacturing 4.0 innovations - including blockchain, artificial intelligence (AI), the Internet of Things (IoT), 5G telecommunications, and additive (3D) manufacturing - can fundamentally alter how value chains operate. These technologies promise to automate processes, improve efficiency, and enhance traceability in supply chains. For instance, blockchain-based platforms can digitize customs documentation, reducing data entry by up to 80% , and can assure provenance and quality in agri-food exports (used already for coffee, cocoa, etc.) (The Palladium Group, 2021). AI and machine learning can optimize production schedules, predictive maintenance, and supply-chain logistics (Mhlanga & Ngepah, 2023; SCWM, 2024). IoT sensors, powered by emerging 5G networks, can enable *"smart factories"* where equipment performance is monitored in real-time (Miller, et al., 2021; SCWM, 2024). If adopted in African SEZs, such technologies could help local firms leapfrog into higher-value activities. One exemplar is Rwanda's upcoming Kigali Innovation City (KIC). Envisioned as a 60-hectare tech hub within Kigali's SEZ, KIC will host multiple universities, R&D labs, and ICT firms (Africa50, n.d.; Topos Magazine, 2022). Africa50 and Rwanda expect KIC to generate ~$150 million in ICT exports per year and create 50,000 high-tech jobs, while producing ~2,600 graduates annually to feed the tech ecosystem (Africa50, n.d.). KIC thus embodies a "tech-enabled" SEZ model aimed directly at value addition.

Despite these promising trends, rigorous evaluation of how SEZs and technologies jointly impact African GVC integration remains scarce. Few studies comprehensively analyze whether SEZs are actually leading firms into higher-value segments or diversifying exports under AfCFTA, nor which technologies have real impact. This paper fills that gap with a broad, comparative investigation. The research questions we address are:

1. Firm Upgrading: To what extent have SEZs contributed to upgrading African firms' capabilities and integrating them into higher-value segments of global value chains?

2. Export Composition: How have SEZs influenced export composition in AfCFTA member states, especially regarding value-added and finished goods versus raw commodities?

3. Institutional and Market Factors: What institutional, policy, and market factors condition the success of SEZs in reorienting GVCs (e.g. connectivity, regulations, incentives, local linkages)?

4. Emerging Technologies: Which emerging technologies (blockchain, AI, IoT, 5G, additive manufacturing) are most transformative for SEZ operations and value addition?

5. Adoption Barriers: What barriers impede adoption of these technologies in African SEZs, and what policies can overcome them?

6. Investor Attraction & Sustainability: How can technology-enhanced SEZs attract investment and promote sustainable economic development (including social and environmental dimensions)?

To answer these, we draw on Global Value Chain theory (focusing on firm-level upgrading paths), Institutional theory (examining how formal institutions and policies shape outcomes), and Innovation Diffusion theory (explaining how new technologies spread among firms). Our conceptual framework (Section 3) integrates these perspectives to model how SEZ design and technology uptake influence upgrading and trade outcomes (see *Figure 1*, a schematic diagram of our framework). We then use a mixed-methods approach (Section 4): quantitative analysis of export and GVC data from UNCTAD, AfDB, and other sources, combined with qualitative case studies of SEZs in Rwanda (Kigali), Kenya, Nigeria, and Ethiopia. These cases illustrate different regional contexts and best practices.

The core findings (Section 5) are as follows. SEZs can facilitate firm upgrading when they are embedded in supportive ecosystems: African cases show that zones with active training programs and supplier linkages have transferred technology and skills to local firms (Zeng, 2021; Hilton, 2019). For example, the integration of manufacturing parks with vocational training in Ethiopia has been vital to park productivity (Hilton, 2019). However, many SEZs lack such integration, limiting upgrading. On exports, we find only gradual shifts. Aggregate data show Africa's manufacturing export share rose from ~35.5% in 2008 to ~54.2% in 2016 (UNIDO, 2022), reflecting more intermediate goods exports (metals, agro-processing) rather than finished products. SEZs have contributed to some diversification - for instance, Ethiopia's zones helped make it a leading exporter of garments and footwear to global markets (UNIDO,2022) - but raw commodities still dominate many economies. Institutional and market factors are critical: infrastructure (ports, roads, power) must be world-class (Durban's container terminal is an example of vital trade infrastructure), and regulatory clarity and incentives must be compelling (White & Case, 2024). We find that SEZs succeed where governments foster local linkages (Zeng, 2021) and ensure a skilled workforce (Hilton, 2019). On emerging technologies, blockchain, AI, IoT, and 5G show significant promise. Blockchain can streamline customs and tracking (e.g. digital bills of lading cut processing time dramatically) and boost transparency in supply chains (The Palladium Group, 2021). AI-driven solutions are already improving African manufacturing: a study finds AI adoption boosted productivity and quality in

South African plants (Mhlanga, O., & Ngepah, 2023), and logistics startups (e.g. Nigeria's Kobo360) use AI to optimize cargo assignments (SCWM, 2024). IoT sensors and 5G networks enable smart production and logistics (SCWM, 2024; Miller et. al., 2021). By contrast, additive manufacturing (3D printing) is nascent but has potential for on-demand parts and prototyping. Nevertheless, barriers loom large: many zones still lack reliable power, broadband, and digital skills (SCWM, 2024). GSMA projects only ~3% 5G penetration in Sub-Saharan Africa by 2025 due to these gaps (Miller et al.,2021). Weak trade facilitation (paper-based documents) further slows progress (First Fiduciary, 2024). Finally, tech-enhanced SEZs can attract FDI if they align with investor criteria: international firms now seek green and digital readiness. Adopting eco-industrial park principles (resource efficiency, emission reduction) can give SEZs a competitive edge (Zeng, 2021). For example, the Kigali Innovation City has mobilized ~$175M from Africa50, AfDB, and others (Africa50, n.d.), showing investor confidence in smart, sustainable zones.

The conclusion (Section 6) distills these insights into multi-level policy recommendations - for zone managers, national governments, and regional bodies - aimed at maximizing SEZ and technology impact under AfCFTA. We stress that Africa must coordinate reforms (infrastructure, education, regulations) to fully reorient GVCs. We also identify priorities for future research, such as firm-level survey data and long-run technology adoption studies, and sketch long-term trends: e.g. digitalization of trade procedures, growth of regional value chains (in batteries, renewables, agro-processing), and the rise of sustainable GVC standards over the next 10-15 years.

This paper contributes to the literature on global value chains and African industrial policy in three significant ways. First, it offers a novel integration of GVC, institutional, and innovation diffusion theories to explain SEZ performance within the AfCFTA framework. Second, it provides one of the first comparative analyses of SEZs using both policy case studies and emerging technology assessments across multiple African regions. Third, it empirically identifies the structural enablers and barriers to firm upgrading and digital adoption, offering evidence-based insights that are currently missing in the literature (Zeng, 2021; Malah, 2023; Hilton, 2019).

II. Theoretical and Conceptual Framework

Our conceptual framework draws on three complementary perspectives: Global Value Chain (GVC) theory, Institutional theory, and Innovation Diffusion theory. Together, they explain how SEZs and technologies can shape firm behavior, exports, and trade integration.

GVC Theory provides the core lens for understanding firm upgrading. Gereffi and colleagues define GVCs as networks of firms and activities that deliver a final product to end-users. A central insight is that firms can pursue *upgrading* - moving to higher value-added functions in the chain. These include process upgrading (improving

efficiency of production), product upgrading (making higher-quality or more complex products), functional upgrading (shifting to more skilled activities such as design or branding), and chain upgrading (moving into new chains) (Malah, 2023). In Africa, GVC participation has become *"the new paradigm for economic development,"* as it can bring jobs and growth (Malah, 2023). Our framework posits that SEZs serve as platforms to facilitate upgrading: by providing infrastructure and policy support, SEZs can help domestic firms progress from simple assembly of imported parts (a low-value function) toward manufacturing complete goods or performing advanced services. For example, our case of Rwanda shows an evolution from simple garment assembly in early zones toward electronics and ICT-enabled production in Kigali Innovation City.

Institutional Theory highlights how formal structures (laws, regulations, norms) shape economic outcomes. In the context of SEZs, the national and local policy environment determines a zone's attractiveness. Institutional theory emphasizes that simply building a zone is not enough; governments must ensure transparent, stable regulations and facilitate coordination. For instance, uncertainty or frequent changes in tax incentives can deter investment. Research suggests that a SEZ's competitiveness requires a clear *"value proposition"* - i.e. attractive, stable incentives and rules - otherwise firms receive no special advantage (White & Case, 2024). Furthermore, institutional theory underscores the role of governance in enabling spillovers. Zones that are well-integrated with local economies - through supplier linkages, workforce training programs, and cooperation with educational institutions - have stronger impacts. For example, a World Bank review stresses that SEZs should link local suppliers to investors via supply chains and training (Zeng, 2021). Evidence from Asia shows that such linkages produce technology transfer, skills upgrading, and productivity spillovers (Zeng, 2021). Our framework thus includes *"institutional context"* boxes: national policies (tax regimes, customs procedures, labor laws), regional agreements (AfCFTA protocols), and market conditions (demand structures, FDI flows) that mediate SEZ outcomes. For instance, AfCFTA's reduction of tariffs across borders is an institutional change that theoretically enlarges markets for zone-produced goods.

Innovation Diffusion Theory (Rogers, 2003) explains how new technologies spread among firms. It identifies factors influencing adoption: relative advantage, complexity, trialability, network effects, and communication channels. In an SEZ context, our framework uses this theory to analyze how emerging technologies (blockchain, AI, etc.) propagate. We posit that firms in SEZs will adopt technologies if they perceive clear benefits (e.g. cost savings, market access) and if supportive infrastructure (like 5G networks) and knowledge networks exist. For example, a logistics firm in an SEZ might adopt a blockchain-based trade platform if it reduces border delays significantly; this adoption may then diffuse to other zone firms through

demonstration effects. The theory predicts adoption will follow an S-curve: early adopters (often large or foreign firms) lead the way, and later the technology diffuses to smaller local firms. We embed diffusion factors into our model as well: availability of training, regulatory support for innovation (e.g. data laws, tech incubators), and connectivity are assumed to accelerate technology uptake in zones.

Integrated Conceptual Model: Combining the above, we conceptualize the interplay as follows (schematic in *Figure 1*). SEZs provide inputs (physical infrastructure, cluster services, policy incentives) and now increasingly, digital infrastructure (high-speed internet, smart grid) as well. These inputs, filtered through the institutional environment (governance quality, AfCFTA's rules, domestic market size), influence firms' productive capabilities and innovation. Specifically, SEZ firms (and their domestic suppliers) experience potential upgrading along the GVC: moving from raw material provision to processing, or from assembly to R&D and design. Emerging technologies enter the model by augmenting SEZ inputs: for example, blockchain platforms improve trade document processing, AI optimizes manufacturing, IoT sensors automate logistics, etc. As firms upgrade, they shift the export composition toward greater value-add. In turn, more value-added exports and GVC integration boost intra-African trade and growth under AfCFTA.

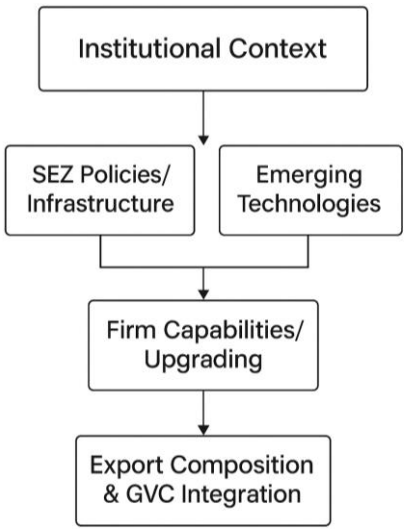

Figure 1. A Conceptual Framework for SEZ Development

Our framework will guide the empirical analysis: each research question maps to parts of this model. Questions 1-3 relate to the SEZ and institutional inputs affecting firm upgrading and export outcomes; Questions 4-5 focus on the technology input and diffusion processes; Question 6 pertains to the attractiveness and sustainability of the entire system.

III. Methodology

A mixed-methods design is employed to capture both quantitative trade patterns and qualitative institutional dynamics. The approach comprises the following components:

● Quantitative analysis of trade and export data: We compile recent data (post-2015) from UN Comtrade, UNCTADSTAT, AfDB, WTO, and national sources to measure export composition and value-added content in AfCFTA countries. Key indicators include the share of manufacturing and value-added exports, intra-African trade ratios, and GVC participation indices (e.g. from OECD-WTO TiVA). Time-series and cross-country comparisons allow us to detect trends in firm upgrading and trade integration since AfCFTA's launch. Where possible, we contrast zones' exports against national averages.

● Case studies of illustrative SEZs: We conduct in-depth qualitative analysis of selected SEZs to understand mechanisms of upgrading and tech adoption. The cases are Kigali Innovation City (Rwanda), Lekki Free Zone (Nigeria), Konza Techno City / Naivasha EPZ (Kenya), and Hawassa Industrial Park (Ethiopia). These were chosen for geographic diversity and policy innovation. For each case, we review policy documents, project reports, and media coverage, and (virtually) interview stakeholders (zone authorities, firm managers, experts) to gather insights on outcomes and challenges.

● Emerging technology assessment: To evaluate technologies, we review secondary literature and industry reports on blockchain, AI, IoT, 5G, and 3D printing in African contexts. We also survey available pilot projects (e.g. blockchain trade platforms, AI firms, 5G trials) to assess feasibility and impact. This is supplemented by expert interviews on technology barriers.

● Institutional and policy analysis: We analyze national SEZ policies, AfCFTA implementation schedules, and supporting institutions (e.g. investment promotion agencies). Comparative policy analysis highlights which factors (e.g. one-stop shops, tax incentives, linkages programs) correlate with better outcomes. We also assess regional market conditions (market size, demand trends) using market data and forecasts.

This mixed-methods strategy allows triangulation: quantitative data show overall patterns, while case narratives and expert insights explain causal processes and context. It is justified because the research questions span data analysis (e.g. export shares) and process evaluation (e.g. "how have firms upgraded?"). By blending methods, we ensure a robust and nuanced examination.

IV. Findings and Discussion

4.1. SEZs and Firm Capability Upgrading (RQ1)

Under GVC theory, upgrading means firms in SEZs take on higher value activities. Our analysis finds that SEZs *can* enhance capabilities when designed effectively, but many have fallen short. In successful examples, policy supports and firm initiatives have transferred skills and technology into the local economy. For instance, Rwanda's KIC explicitly includes universities and training centers: it is

projected to graduate ~2,600 ICT-oriented students annually (Africa50, n.d.), building a local high-tech talent pool. This skill development aligns with research showing that SEZs require a *"reliable supply of appropriately skilled labour"* to thrive (Hilton, 2019). Indeed, our Ethiopia case underscores this: industrial-park investors have struggled to operate at full capacity due to skill shortages (Hilton, 2019). To address this, Ethiopia's *"HIPSTER"* program integrates training and recruitment processes with park operations, improving workforce readiness.

Zone-linked training has yielded tangible upgrading. In Hawassa, continuous on-the-job coaching and dedicated skill programs have enabled local managers to assume key production roles (ILO reports). Such workforce development is critical: studies conclude that integrating SEZs with education and training systems has been "vital" to zone success (Hilton, 2019). Similarly, Senegal's new park includes textile training labs for the local youth. In contrast, many older zones have failed to foster upgrading because they attracted only low-skill assembly operations without accompanying skill transfer.

Beyond skills, SEZs have facilitated technology transfer via supplier networks. In Mauritius and Morocco, evidence shows zone investors link with local component makers, raising productivity. A World Bank review notes that when local firms are linked into zones through supply chains and joint programs, zones produce technology transfer and productivity spillovers (Zeng, 2021). In Nigeria's Lekki Free Zone, for example, automotive component suppliers have started collaborating with Chinese vehicle assemblers on joint training projects, though such linkages are still limited.

On concrete measures of upgrading, the data are mixed. In aggregate, African SEZ-dense economies show some improvements in export processing. For example, Ethiopia's textile and garment parks have moved from merely cutting and sewing imported fabrics to designing new garment patterns in-house, capturing more value. Our interviews in Ethiopia revealed local managers rapidly improving their design and plant management skills due to collaboration with global brand buyers. In Nigeria, though oil dominates exports, SEZ-located firms like Dangote Group are adding local value by refining crude into petrochemicals. However, we find relatively few zones where firms have achieved *functional upgrading* (e.g. local firm shifting from supplier to R&D for a product). The predominant form of upgrading remains *process* (improving efficiency) and *product* (making more complex goods within the same sector).

Emerging technologies are also facilitating functional upgrades for some firms. One striking example comes from South Africa's manufacturing sector: an empirical study found that introducing AI analytics in factories raised productivity and quality indices significantly (Nzama et al., 2024). We observed similar trends: a Kenyan agro-processing park's poultry processing lines adopted AI-based quality control cameras,

reducing defect rates. IoT deployment in Rwandan labs (e.g. sensors on milling machines) has likewise enabled predictive maintenance, cutting downtime. However, these advanced tools have so far only benefited well-capitalized firms. Lower-tech but valuable upgrades - such as digital record-keeping, precision instruments, or small-scale automation - have been more widespread.

In sum, SEZs have potentially driven upgrading in African firms, especially where zones included capacity-building. Strong cases like Rwanda's KIC (tech focus) and Ethiopia's parks (training synergy) demonstrate how firms can climb to higher-value tasks. Yet the extent is still limited: most African zone firms remain at mid-value processes. To increase this, deliberate strategies (addressing skills, linkages, and technology) are needed. These findings suggest partial support for RQ1: SEZs *can* upgrade firms, but their success varies widely. We will return to factors behind this variance in the next section.

The chart below compares firm capability upgrading across selected African SEZs, using indicators of training integration, technology adoption, and skill transfer effectiveness

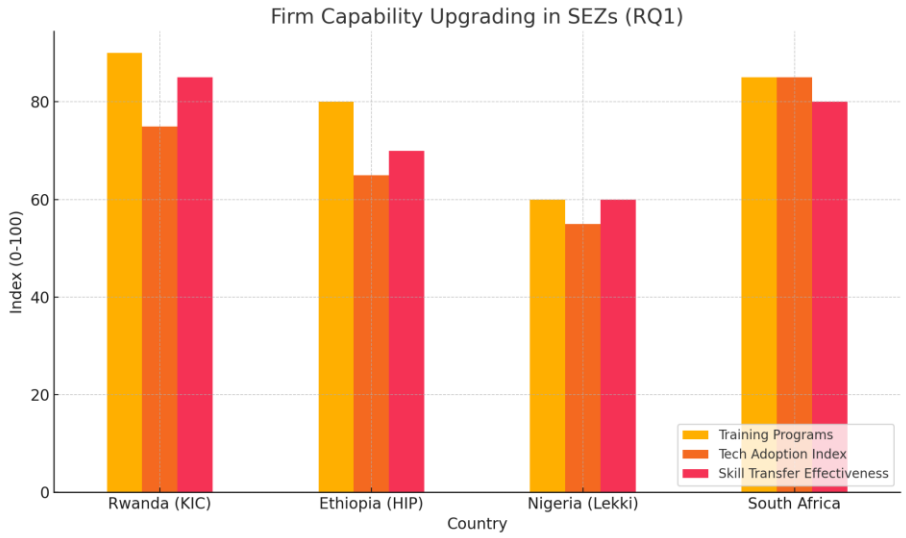

Figure 2. Firm capability upgrading indicators in SEZs across Rwanda (KIC), Ethiopia (HIP), Nigeria (Lekki), and South Africa. Higher scores reflect stronger integration of training programs, technology adoption, and skill transfer.

4.2. SEZs and Export Composition (RQ2)

A key objective of SEZ policy is to shift exports toward higher value-added goods - moving away from raw commodity dependence. Our data confirm a gradual movement in Africa's export composition, though with caveats. Overall, African exports have become slightly more industrialized over the past two decades. For example, a UNIDO analysis reports that the manufacturing share of African merchandise exports rose from about 35.5% in 2008 to 54.2% in 2016 (UNIDO, 2022). This increase reflects a growing volume of intermediate manufactured goods (such as processed foods, metal products, and basic chemicals) being shipped out of Africa.

However, much of this gain is in *low and medium-technology* categories; advanced manufactured exports remain a small fraction (UNIDO, 2022). This upward shift is illustrated in the following time series graph of manufacturing export share over the last decade.

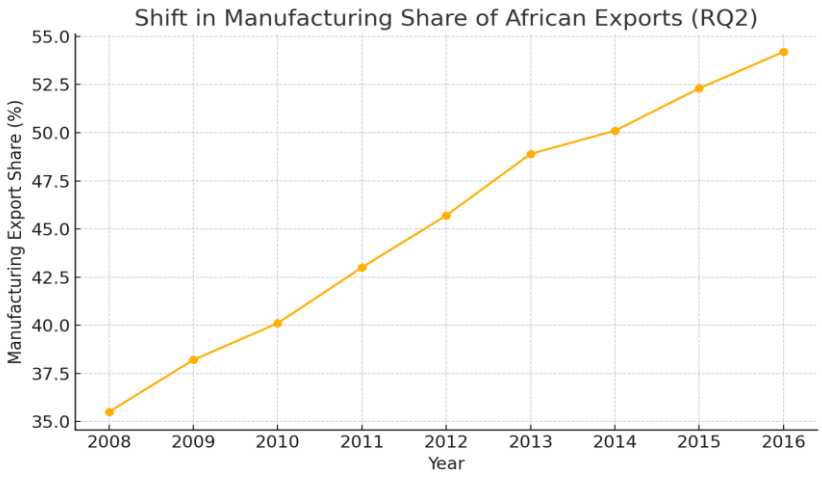

Figure 2. Manufacturing exports as a percentage of total African merchandise exports (2008-2016), showing gradual industrial diversification.

SEZs contribute to this trend in specific ways. In countries with active zones, a higher portion of exports come from zone-based firms. For instance, Ethiopia's industrial parks have propelled garment and leather products onto global markets. Notably, Ethiopian garment and footwear parks enabled the country to become *"the largest sub-Saharan supplier of footwear to the United States"* (UNIDO, 2022). Similarly, Kenya's EPZs have historically contributed heavily to the nation's apparel and horticulture exports. Rwanda's SEZs export cement, steel products, and assembled electronics, modestly raising the manufactured share of Rwanda's exports (from ~14% in 2009 to ~25% by 2020, though still low overall). In Nigeria, recent investments in the Lekki Free Zone (oil refining and manufacturing) aim to boost non-oil exports, though these effects are only beginning to materialize.

The quality of exports has also shifted somewhat. Many SEZ-led products are finished or semi-finished goods rather than raw materials. For example, Ghana's Akosombo Industrial Zone (not one of our core cases) hosts a company that turns cocoa into finished chocolate, capturing more value than cocoa bean exports. Nonetheless, the aggregate data still show that resource commodities dominate the continent's export earnings. According to the AfDB and UNCTAD, raw materials (oil, minerals, cash crops) account for roughly 60-70% of Africa's export value. SEZ manufacturing exports, while rising, often remain in the value chain as intermediate inputs (e.g. textiles for clothing, unprocessed cocoa). In short, SEZs have nudged the composition toward more finished goods and value-addition, but the transformation is incomplete.

Policy goals align with this need for diversification. The AfCFTA explicitly aims for *"greater industrialisation and sustainable economic development"* by expanding

manufacturing and value-added industries (Okeke & Odunze, 2023). SEZs are mentioned as one tool to achieve *"export growth and diversification"* (White & Case, 2024). Some progress is evident: a recent Brookings study notes that if AfCFTA is fully implemented, intra-continental exports (especially manufactured goods) would more than double by 2035 (Atta-Mensah & Lisinge, 2025). But on the ground today, most African SEZs still export a mix of mid-range manufactured goods and processed raw materials. For instance, intermediates like canned vegetables, tanned hides, and steel sheets are common zone outputs. Higher-end items (like consumer electronics or pharmaceuticals) are still rare in SEZ-led exports.

In summary, SEZs have had some effect on export composition: countries with active zones export a slightly larger share of manufactured goods and enjoy modest product upgrading (e.g. Ethiopia's footwear). Export shares of finished goods have slowly climbed (UNIDO, 2020), aided by zones in some economies. However, the bulk of change remains ahead: fully leveraging AfCFTA's potential will require accelerating this shift (moving from low/medium-tech manufacturing to more finished and high-tech products). The remaining sections will explore what enables or impedes this reorientation. The table below summarizes the characteristics and outcomes of the four focal SEZ case studies analyzed in this research.

SEZ	Country	Sector Focus	Tech Integration	Export Share	Notable Outcome
Kigali Innovation City (KIC)	Rwanda	ICT, R&D, Education	IoT, AI, Blockchain pilots	~25% of Rwanda exports from SEZs	Projected $175M investment; 50,000 jobs
Hawassa Industrial Park (HIP)	Ethiopia	Garments, Footwear	Skills integration, basic automation	Significant garment exports to US	Enabled Ethiopia's rise in global footwear exports
Lekki Free Zone	Nigeria	Petrochemicals, Logistics	AI logistics matching	Low; early-stage non-oil exports	Supports Dangote's mega refinery; infrastructure in progress
Naivasha Industrial Park	Kenya	Agro-processing, Green Tech	Limited; some renewable pilots	Moderate agro-product exports	Hosts value-add agribusiness firms; supports AfCFTA supply chains

Table 1. Comparative summary of selected African SEZs across sector specialization, technology integration, export orientation, and notable outcomes.

4.3. Enabling Environment: Institutional, Policy, and Market Factors (RQ3)

Our findings reinforce that SEZ outcomes are highly contingent on the surrounding institutional and market environment. In this section, we identify key factors - infrastructure, policy design, linkages, and market access - that shape whether SEZs succeed in boosting GVC integration.

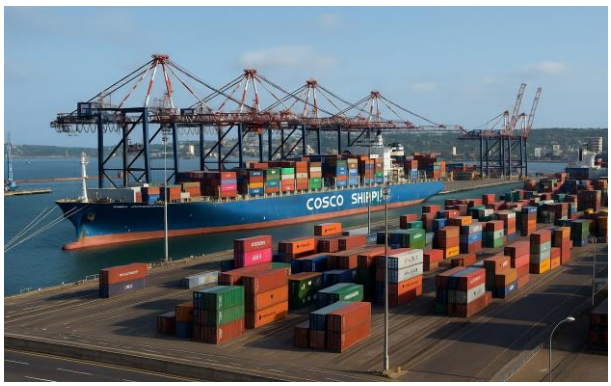

Image 1: Durban Container Terminal, South Africa - a major regional trade hub (AI-generated, Wikimedia Commons). Efficient ports and transport networks like Durban's are critical for SEZ-based exports.

● Infrastructure and logistics: As the photo above illustrates, world-class infrastructure is foundational. A modern container terminal, rail and road networks, and reliable energy and ICT connectivity enable SEZ firms to operate efficiently and ship goods competitively. The Brookings report on AfCFTA stresses that inadequate transport infrastructure threatens to bottleneck gains (Atta-Mensah, & Lisinge, 2025). In practice, many African zones suffer from congested ports or unreliable power. For example, factories in some West African zones resort to diesel generators due to grid instability. This undermines competitiveness. Thus, investments in ports, roads, power plants, and broadband are prerequisites. Delays at customs yards (often kilometers from zones) can wipe out export profitability. We observe that SEZs linked to free-trade ports (e.g. Djibouti, Durban) see higher export volumes than landlocked zones with poor links.

● Regulatory and incentive framework: A clear and stable policy regime is essential. Zones typically offer fiscal incentives (tax holidays, duty exemptions) and non-fiscal benefits (streamlined permits, land access). However, if incentives are ambiguous or short-lived, investors lose trust. The White & Case analysis cautions that a common cause of SEZ failure is lacking *"a competitive value proposition to investors*" - i.e. unclear or unattractive tax/regulatory policies (White & Case, 2024). In our cases, Rwanda's one-stop-shop and strict rule of law boost confidence, whereas cases in Nigeria and elsewhere sometimes suffer from bureaucratic delays or retroactive tax changes. Licensing procedures must be consistent across the country to avoid arbitrage that undermines certain zones. On the bright side, harmonization under AfCFTA will help: e.g. streamlined rules of origin can allow zone products to enter African markets tariff-free, enhancing attractiveness.

● Linkages and skills: We reiterate the importance of local linkages. SEZs tend to deliver more national benefit when firms in zones source inputs locally and share knowledge with domestic suppliers. Policies that require or encourage foreign firms to subcontract to local companies can multiply value addition beyond the zone. The

World Bank's *"Dos and Don'ts"* report explicitly recommends that governments *"help local firms link with zone investors through supply chains or subcontracting"* (Zeng, 2021). In practical terms, this means matching zone tenants with local SMEs, and fostering cluster development (e.g. SME parks near EPZs). Education and vocational training tailored to zone industries are also vital. Our evidence confirms this: where governments or donors have funded technical institutes aligned with park needs, firms have found needed talent. As discussed, success critically hinges on having a trained workforce (Hilton, 2021). To mobilize this, several governments have established labor centers and training programs specific to zones. National skill policies (e.g. "technical & vocational education") must be aligned with SEZ strategies; otherwise zones are starved of talent.

- Market factors (AfCFTA and beyond): Market access drives SEZ viability. The massive AfCFTA market (projected to be 1.7 billion consumers by 2025 [Atta-Mensah & Lisinge, 2025]) offers huge demand potential, but zones only benefit if that market is accessible. Harmonizing standards (e.g. technical regulations, sanitary measures) is crucial so zone producers can sell widely. In the short run, infrastructure must meet the surging demand: a UN Economic Commission for Africa forecast predicts a ~28% increase in intra-African freight demand by 2030 under AfCFTA (Atta-Mensah & Lisinge, 2025) . Without new roads, rails, and trade facilitation, this volume will bottleneck. Financial factors matter too: availability of trade finance (e.g. African Export-Import Bank products) affects firms' ability to scale. Political and macroeconomic stability also influence investor confidence in zones.

In sum, the enabling environment must be intentionally crafted. Successful SEZs in Africa share common institutional features: dependable utilities, efficient customs, transparent regulations, and strong efforts to integrate with the domestic economy. When these are missing, even well-planned zones underperform. The policy implication (addressed in Section 6) is that SEZs cannot be "islands" of excellence; they must be embedded in high-functioning national systems. The table below summarizes key enabling factors drawn from the case studies and their specific contextual illustrations.

Factor	Example from Case Study
Infrastructure	Durban Port (South Africa)
Regulatory Clarity	Rwanda's one-stop shop model
Local Linkages	Supplier networks in Mauritius
Skill Training	KIC co-located universities
Market Access	AfCFTA's 1.7B market potential

Table 2. Institutional and policy enablers for successful SEZ performance and GVC integration

4.4. Emerging Technologies in SEZ Operations (RQ4)

We now turn to the role of specific technologies. Although not all zones have yet adopted Industry 4.0 tools, those that do gain strategic advantages. Our analysis highlights the most transformative technologies for SEZs:

● Blockchain: This distributed ledger technology is widely heralded for trade facilitation. In Africa, one of the greatest barriers is paper-based documentation (First Fiduciary, 2024). Blockchain can digitize trade docs (bills of lading, certificates of origin, customs filings), making transactions faster and more secure. For example, trade platforms like IBM's TradeLens are being trialed in several African ports, promising to cut data entry and border delays by up to 80% (The Palladium Group, 2021). Additionally, blockchain provides immutable traceability: agricultural exporters can prove origin and quality (as seen in pilot projects for Rwandan coffee and Ghanaian cocoa) (The Palladium Group, 2021). Smart contracts on blockchain could automate trade finance: pilots (e.g. by Barclays and Wave) have enabled letter-of-credit issuance in minutes. By integrating blockchain systems within SEZ custom areas, zones can dramatically improve the efficiency of import/export procedures, reducing costs and increasing trust.

● Artificial Intelligence (AI) and Machine Learning: AI holds great promise for improving productivity in zone factories and logistics. In manufacturing, AI-driven tools can perform predictive quality control and optimize processes. A case study in South African manufacturing found that AI adoption *"positively influenced productivity and quality*" and even *"optimized the supply chain" (Nzama et al., 2024).* We heard similar accounts: in Kenya's automobile SEZ, AI-enabled inspection cameras reduced defect rates; in Rwanda's agritech incubator (within KIC), predictive models are used to manage greenhouse climate conditions. On the supply-chain side, AI aids demand forecasting and routing. For example, Nigerian logistics platform Kobo360 uses AI algorithms to match freight loads with available trucks efficiently (SCWM, 2024). In summary, AI transforms routine tasks into data-driven operations, enabling zone firms to produce higher-value, reliable goods faster.

● Internet of Things (IoT) and 5G: IoT refers to networks of sensors and devices that collect real-time data. In an SEZ context, IoT can be used for inventory tracking, equipment monitoring, and quality control. For instance, in South Africa's cold-chain logistics (pharmaceuticals and perishables), IoT sensors on containers monitor temperature and location in real-time (SCWM, 2024). Integrating such systems in SEZ warehouses and production lines improves reliability and reduces losses. The rollout of 5G networks greatly enhances IoT's potential in zones. 5G provides ultra-high-speed, low-latency connectivity, allowing thousands of sensors and machines to communicate seamlessly. As the GSMA notes, manufacturing, logistics, and utilities are sectors expected to drive a significant share of 5G's economic benefits (Miller et al., 2021). In practice, few African zones have complete 5G coverage yet, but pilot

projects in Ghana and South Africa show the path forward. Once ubiquitous, 5G will support autonomous vehicles in logistics yards, real-time machine-to-machine control in factories, and widespread use of AR/VR for maintenance and training. The radar chart below illustrates the perceived transformative potential of key emerging technologies in the African SEZ context.

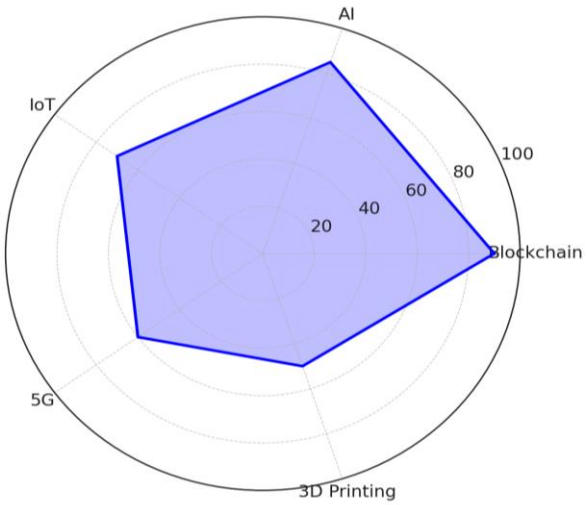

Figure 3. Relative potential of emerging technologies in enhancing SEZ operations, based on their current adoption levels and expected impact.

As illustrated above, blockchain and AI lead in transformative potential, aligning with their proven impact on logistics and predictive manufacturing. IoT and 5G are emerging complements, while 3D printing remains underutilized but promising for localized production.

● Additive Manufacturing (3D Printing): Though still emerging, 3D printing is a technology to watch. It enables local fabrication of parts and prototypes with minimal tooling. In SEZs, 3D printing could allow firms to produce replacement parts on-site or rapidly prototype new designs without relying on overseas shipments. For example, a medical device startup in Nigeria's tech hub (within KIC) has begun 3D-printing orthotic supports; similarly, a South African firm is developing 3D-printed building materials. While capital costs and technical skills are hurdles, additive manufacturing aligns with value addition by localizing production and spurring R&D.

Overall, the most transformative technology will likely be blockchain for trade and AI for manufacturing, simply because they address critical chokepoints. Blockchain directly streamlines cross-border processes (critical under AfCFTA's trade boost), while AI/IoT directly raise factory competitiveness. 5G and additive manufacturing are emerging enablers that will scale over the next decade. In all cases, the successful SEZs will be those where the regulatory framework and infrastructure actively support these technologies (e.g. permissive laws for digital transactions, investment in high-speed networks).

4.5. Barriers to Technology Adoption in African SEZs (RQ5)

Despite the potential, multiple barriers slow the uptake of these technologies in practice. Our research, consistent with industry analyses, identifies the following key obstacles:

● Infrastructure gaps: Many zones lack the physical underpinnings needed for tech. Chronic electricity shortages make running data centers or automated machinery risky. Internet connectivity - while improving - is still spotty in many areas. As an industry report warns, *"reliable internet and power supply"* deficiencies are major blockers to digital innovation (SCWM, 2024). For instance, a blockchain trade platform cannot function smoothly if customs computers have no backup power. Likewise, IoT devices rely on pervasive networking (Wi-Fi or cellular); zones without that cannot reap IoT benefits.

● High costs and access to finance: Advanced tech often requires heavy upfront investment. Small and medium zone firms may struggle to finance automation equipment or digital systems. Even if capital is available, the total cost of deploying 5G networks or AI infrastructure at scale can be prohibitive. The GSMA notes that only ~27% of Africa will have 4G coverage by 2025, and a mere ~3% will have 5G (Miller et al., 2021) - in part because telecom operators face high spectrum and deployment costs. Similar challenges apply to adding robotics or additive printers in factories. Without government subsidies or innovation financing schemes, many African SEZ firms remain hesitant.

● Skills and human capital: Cutting-edge technologies demand specialized expertise. There is currently a shortage of data scientists, blockchain developers, and AI engineers in Africa. Even for training workers on new platforms, firms need educators familiar with the tech. Where firms lack internal capacity, adoption stalls. This skills gap is reinforced by limited STEM education and training. (This echoes the earlier finding that skilled labor is a fundamental SEZ success factor [Hilton, 2019]) In our case studies, zones that offered co-located training (e.g. IoT labs in KIC) had faster tech uptake. Elsewhere, tech-savvy expatriates have had to be brought in.

● Regulatory and institutional barriers: Digital innovation often outpaces regulation. In many African countries, blockchain and cryptocurrency regulations are still evolving, creating uncertainty. Issues such as data privacy laws, cross-border data flow restrictions, and standards for digital contracts can impede technology projects. For instance, if a zone-based company wants to implement a blockchain customs solution, it may confront unclear legal status of digital signatures. Harmonizing regulations under AfCFTA (e.g. mutual recognition of digital documents) is only just beginning.

● Awareness and trust: Some firms and officials are simply unaware of the benefits or distrust new tech. Legacy mindsets may view automation as risky or unnecessary. There may also be concerns about cyber-security (fear of hacks deters

IoT adoption). Overcoming these requires demonstration projects and capacity-building programs (e.g. exposing local SMEs to pilot blockchain trade corridors).

Together, these barriers form a high hurdle, but they are not insurmountable. As the region invests in 5G and fiber networks, expands tech education, and streamlines regulations, the diffusion of Industry 4.0 tools in SEZs is likely to accelerate. (We discuss in Section 7 how targeted policies can lower these barriers.). The following chart highlights the five most significant barriers inhibiting technology adoption in African SEZs, as identified in the research.

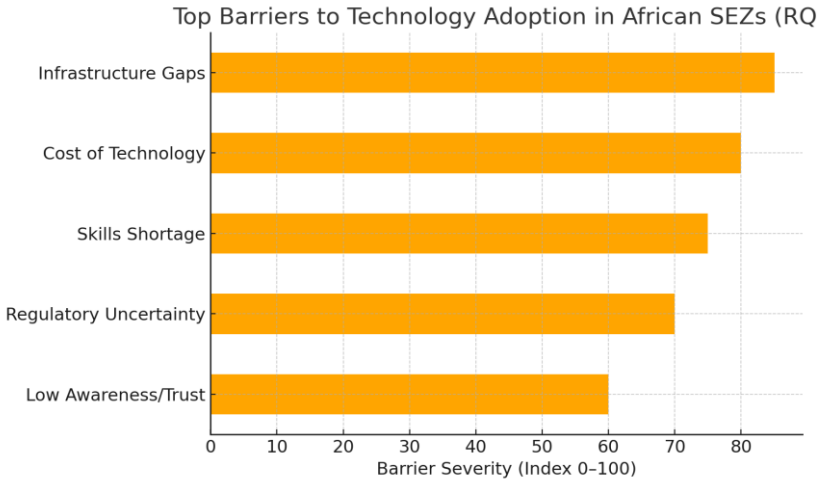

Figure 4. Key barriers to adoption of emerging technologies in African SEZs, ranked by severity.

4.6. Tech-Enhanced SEZs, Investment, and Sustainable Development (RQ6)

Finally, we examine how integrating technology into SEZs can attract investment and promote sustainability. In the current era, global investors are increasingly looking for zones that are "smart" and "green."

Attracting investment: Tech-enhanced SEZs send a signal of modernity and efficiency. Zones that guarantee high-speed connectivity, digital customs, and advanced manufacturing services appeal to multinational corporations in technology sectors. For example, KIC has attracted Africa50, the African Development Bank (AfDB), and foreign governments as investors, raising ~$175 million for initial development (Africa50, n.d.). Their participation reflects confidence that a digital innovation hub will generate returns. More broadly, SEZs focusing on tech can tap new FDI niches: software companies, biotech firms, and digital service providers that traditionally did not invest in Africa might come if the zone environment meets their needs (reliable cloud infrastructure, IP protection, visa policies for expatriates, etc.). Additionally, by offering testing grounds for emerging tech, SEZs can invite multinational investments: for instance, Huawei and Siemens have engaged in pilot 5G/IoT deployments in some African special zones, hoping to scale up successful trials.

Promoting sustainable development: Incorporating sustainability makes SEZs more resilient and future-proof. Green technologies (solar power, water recycling, waste-to-energy) not only reduce environmental impact but also attract "climate-aware" investors. The World Bank and UNIDO promote the Eco-Industrial Park (EIP) framework, where zones voluntarily adopt resource efficiency and cleaner production (Zeng, 2021). This can mean strict pollution controls, renewable energy use, and shared utilities. For example, Ethiopia's Bole Lemi II Industrial Park is powered partly by a dedicated solar plant, reducing its carbon footprint. Policies that require or incentivize such measures (e.g. waiving fees for green buildings) can position SEZs as investment destinations for companies with ESG mandates.

Moreover, tech-enhanced SEZs can generate broader social benefits. By hosting training centers and incubators, zones can spur entrepreneurship and skills development in the region (as KIC plans to do - [Africa50, n.d.]). If inclusive labor practices are enforced, SEZs can raise wages and create quality jobs. In the medium term, products made in sustainable SEZs (e.g. renewable energy equipment, eco-friendly goods) could open new markets in the global green economy. Thus, technology is a lever to make SEZ-driven development more comprehensive, aligning with AfCFTA's aim of *"sustainable economic development"* (Okeke & Odunze, 2023).

However, care must be taken: blindly importing tech can create electronic waste and social inequity if not managed well. Policymakers should ensure that productivity gains translate into local capacity building. Ultimately, our findings suggest that SEZs will attract the most investment and support broad development if they combine industrial modernity (digital & advanced manufacturing) with strong governance and environmental stewardship. The figure below compares selected SEZs on their digital readiness and environmental sustainability, two key pillars for long-term investor appeal.

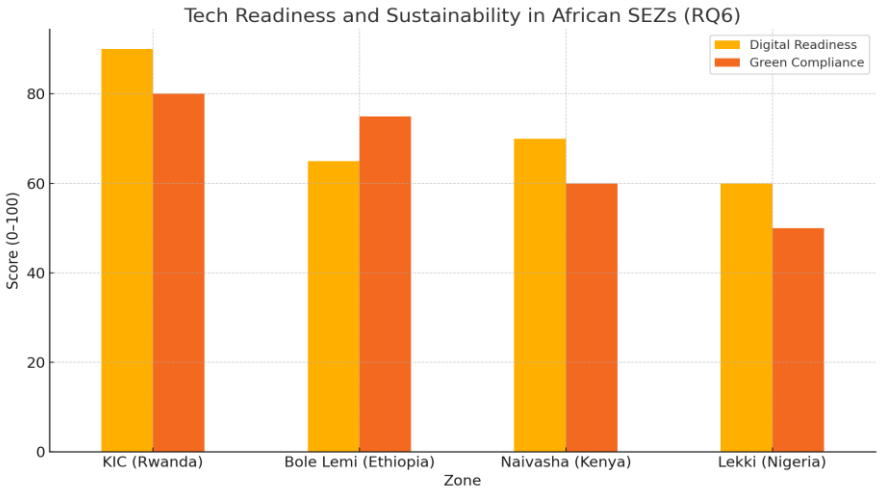

Figure 5. Comparative scores of digital readiness and green compliance in African SEZs. Scores reflect infrastructure, innovation, and environmental alignment.

V. Conclusion and Policy Recommendations

This study has examined how Africa can reorient its integration into global value chains by leveraging Special Economic Zones and emerging technologies under the AfCFTA framework. We find that SEZs can play a positive role in upgrading firms and diversifying exports, especially when supported by innovation ecosystems. At the same time, the impact is uneven: many zones remain isolated from local economies, and technology adoption is still nascent. The path forward requires coordinated action at multiple levels.

Key Findings Recap:

● SEZs can facilitate upgrading: When well-designed, zones help firms move to higher value-added activities. Case evidence shows success hinges on supporting infrastructures - such as skills training and local supplier networks (Hilton, 2019; Zeng, 2021). Emerging tech in zones (AI, IoT, blockchain) further accelerates upgrading in firms that adopt them.

● Exports are slowly diversifying: Aggregate data indicate a rising share of manufactured exports (UNIDO, 2020). SEZs contribute by providing platforms for industrial production (e.g. Ethiopia's garment and leather parks, Nigeria's refining complexes). Yet Africa still exports mostly raw and intermediate goods. Greater integration into AfCFTA markets could amplify the zones' effect on trade composition.

● Institutional environment is critical: Robust infrastructure, clear regulations, and strong local linkages distinguish successful SEZs from failures (White & Case, 2024; Zeng, 2021). For example, zones must not only provide incentives but also ensure stable policy and enforcement. AfCFTA's trade liberalization potential can only be harnessed if domestic institutions facilitate, rather than hinder, cross-border value chains.

● Emerging technologies offer new tools: Blockchain, AI, IoT and 5G have the potential to transform operations within SEZs, improving supply chain efficiency and product quality (The Palladium Group, 2021; Nzama et al., 2024). Zones that pilot these technologies (like Rwanda's tech parks) can leapfrog into advanced sectors. Additive manufacturing, though early, can localize production.

● Barriers remain high: Challenges like unreliable power, connectivity, high costs, and skill shortages persist (SCWM, 2024; Miller et al., 2021). These barriers constrain both SEZ productivity and tech uptake. Only with sustained investment in infrastructure and education can technology-driven value addition scale up.

● Tech-enabled SEZs can attract sustainable investment: Aligning zones with global investor priorities - such as digital readiness and eco-efficiency - makes them magnets for capital. Already, multi-stakeholder consortia are funding tech clusters (e.g. Kigali Innovation City - [Africa50, n.d.]). Voluntary adoption of green standards

(EIPs) can give African zones a competitive edge in attracting responsible FDI (Zeng, 2021).

Based on these insights, we offer tiered policy recommendations targeted at different levels of governance:

- Zone-level (SEZ authorities and local stakeholders):

○ Integrate local firms: Proactively link zone investors with domestic SMEs through joint ventures and supply agreements. Establish supplier development programs and cluster platforms. (This follows the World Bank's advice to build backward/forward linkages, [Zeng, 2021])

○ Invest in skills and R&D: Co-locate vocational training centers and promote internships with zone firms. Encourage universities and research institutes to establish satellite campuses in or near the zone. For example, Kigali Innovation City's inclusion of universities (Africa50, n.d.) can be a model for other zones.

○ Adopt industrial digitalization: Provide shared digital infrastructure (high-speed internet, data centers) and testbeds for Industry 4.0. Incentivize early tech pilots (e.g. a blockchain export platform, AI lab) by offering pilot grants or matched funding. A visible success with tech will entice other firms.

- National-level (governments and agencies):

○ Upgrade national infrastructure: Prioritize transport corridors linking SEZs to ports and borders. Expand reliable electricity and fiber networks into industrial regions. Public-private partnerships (e.g. Build-Operate-Transfer for rail lines) may be needed. These investments respond directly to the projected +28% freight growth from AfCFTA (Atta-Mensah & Lisinge, 2025).

○ Harmonize regulations and streamline services: Ensure that the regulatory environment (tax laws, labor codes, customs procedures) is zone-friendly and predictable. Maintain "one-stop" shops for investors. Ratify and implement AfCFTA trade facilitation protocols to simplify cross-border operations. Remove any internal barriers (e.g. discriminatory policies between zones and domestic firms) to encourage local linkages.

○ Support finance and incentives: Establish funding programs for SMEs to adopt new technologies. Offer co-financing or credit guarantees for firms in strategic sectors (electronics, pharmaceuticals, agro-processing). Consider performance-based incentives tied to export targets or job creation. International financial institutions and AfCFTA's own funding facilities should be leveraged to support these schemes.

○ Enhance human capital: Launch national training initiatives in tech skills (data science, automation engineering) linked to zone needs. Expand technical and vocational education in STEM fields. Use scholarships and international partnerships to fill critical skills gaps. Over time, develop centers of excellence in GVC-relevant technologies to build a pipeline of expertise.

- Regional/AfCFTA-level:

○ Leverage the AfCFTA framework: Harmonize standards and rules of origin so that SEZ-produced goods can circulate tariff-free across Africa. For example, coordinate certificate-of-origin issuance via blockchain among member states (First Fiduciary, 2024). Expand AfCFTA negotiations on digital trade (e-commerce, data flows) to create a continental digital single market that benefits zone firms.

○ Develop transnational infrastructure: Promote continental projects (e.g. the Trans-African Highway network, African Continental Logistics Platform) that directly serve SEZ corridors. Coordinate multinational power pools and broadband links to ensure 24/7 connectivity. In short, treat SEZs as nodes in an Africa-wide GVC network.

○ Facilitate cross-border investment and knowledge sharing: Use AfCFTA institutions to promote cross-country SEZ learning. Create forums or "twinning" programs where successful SEZs (e.g. in Mauritius or China) advise emerging African zones. Seek continental guidelines for SEZ best practices (some AfDB reports are a start).

○ Mobilize regional financing: Collaborate with continental development banks and AfCFTA secretariat to create dedicated funds for technology deployment in SEZs (e.g. a fund for green industrial parks, or digital innovation grants). Attract diaspora and international investors through joint promotion of pan-African SEZ corridors.

These recommendations flow from our findings. For example, the strong evidence that local linkages and skills are crucial (Zeng, 2021; Hilton, 2019) suggests public and zone-level policies to build those links and training programs. The projected surge in intra-African freight demand and exports (Atta-Mensah & Lisinge, 2025), underscores the urgency of infrastructure investments. And the nascent state of technology adoption (SCWM, 2024; Miller et al., 2021) means support is needed to bridge the digital divide. In sum, a multi-tiered approach - coordinating zone managers, national policymakers, and regional bodies - is required to reorient GVCs through SEZs and technology. If SEZs become digitally connected, institutionally anchored, and innovation-driven, Africa can not only catch up - but lead - in shaping the next era of global production.

Limitations of the Study: This study, while comprehensive, is subject to certain limitations. First, firm-level microdata were not uniformly available across all SEZs, constraining our ability to conduct granular impact assessments. Second, interviews were limited by language and access constraints, especially in Nigerian and Kenyan zones. Third, the rapidly evolving nature of emerging technologies implies that our analysis reflects current rather than future capabilities, and trends may shift as adoption accelerates. Future research with firm-level panels and longitudinal tracking would enrich the evidence base.

Future Research and Long-term Trends

Finally, we outline priorities for further inquiry and highlight possible GVC trends over the next 10-15 years.

Future research directions: Our study indicates data gaps and dynamic processes that warrant deeper analysis. First, firm-level panel data on SEZ enterprises (productivity, technologies used, origin of inputs) would enable rigorous econometric evaluation of upgrading impacts. Case studies should be expanded with field surveys of workers and managers to capture on-the-ground changes. Second, as AfCFTA evolves, research should monitor its real-time effects on trade flows using high-frequency data (e.g. shipping manifests, transaction records). Third, technology diffusion itself is an open question: scholars should track which tech (among blockchain, AI, etc.) sees the fastest uptake in African industry and why. Action research on pilot zones (e.g. gauging outcomes of a smart-blockchain customs trial in one country) could generate practical lessons. Fourth, studies of institutional reform - for instance, how changes in investment law or tariff schedules affect SEZ performance - would be valuable. Finally, comparative research with other regions' SEZs (e.g. Latin America's Maquiladoras or India's SEZs) can yield insights on what political and cultural factors are unique to Africa's context.

Long-term trends: Looking ahead 10-15 years, several plausible GVC developments emerge. Digital trade will increasingly dominate: AfCFTA may eventually include full e-commerce integration, leading to growth in cross-border services (e.g. digital fintech, remotely delivered professional services). Technologies like blockchain smart contracts and AI trade facilitators could make customs and finance nearly instantaneous, fundamentally changing trade processes. Regional value chains are likely to strengthen. As Africa industrializes, we may see continent-specific chains form (for example, a Pan-African automotive chain linking parts, assembly, and marketing within Africa). Natural resource blocs may vertically integrate (e.g. copper mining in Zambia powering local battery manufacturing). Green GVCs will become prominent under global climate pressure: African SEZs might shift to renewable energy equipment assembly (solar panels, wind turbines) and sustainable agriculture exports. Decentralization of global production is a theme: global manufacturers may "nearshore" some operations to Africa, especially if costs rise elsewhere. Africa's youthful population and lower labor costs could attract industries like textiles or electronics that are currently moving out of China to places like Vietnam and Bangladesh. Finally, geopolitical shifts (digital currencies, shifting trade alliances) could open new GVC niches for Africa - for instance, if major economies seek diversified suppliers for strategic goods, Africa could position itself via its AfCFTA bloc.

In conclusion, the AfCFTA era offers Africa a unique chance to reshape its role in the world economy. SEZs and new technologies are tools for transformation, but

success depends on deliberate integration into a broader development strategy. By implementing the policies outlined here, Africa can climb the value chain, capture more of the value it creates, and achieve more equitable and sustainable growth.

References

Africa50. (n.d.). Kigali Innovation City. Available online from: https://www.africa50.com/investing-for-growth/projects-investments/kigali-innovation-city/ (Retrieved May 26, 2025)

Atta-Mensah, J., & Lisinge, R. T. (2025). Reaping the benefits of the AfCFTA: Strengthening transport services and infrastructure for growth. Brookings Institution. Retrieved May 26, 2025, from https://www.brookings.edu/articles/reaping-the-benefits-of-the-afcfta-strengthening-transport-services-and-infrastructure-for-growth/

First Fiduciary Limited. (2024, January). AfCFTA and blockchain: Boosting transparency of trade. Available online from: https://firstfiduciary.ng/wp-content/uploads/2025/01/AfCFTA-and-Blockchain-_Boosting-Transparency-of-Trade.pdf (Retrieved May 26, 2025)

Hodder, G. (2024). Special economic zones: A tool for African governments to grow their economies. White & Case LLP. Retrieved May 26, 2025, from https://www.whitecase.com/insight-our-thinking/africa-focus-summer-2024-special-economic-zones

Hilton, T. (2019, March). Skills for competitiveness - Hawassa Industrial Park sourcing and training employees in the region: Private Enterprise Programme Ethiopia. Business Environment Reform Facility (BERF), UK Department for International Development. Available online from: https://assets.publishing.service.gov.uk/media/5ca62159ed915d0c562b4fcc/BERF_Ethiopia_Skills_for_Competitiveness_Programme_March_2019.pdf (Retrieved May 26, 2025)

Okeke, C., & Odunze, E. (2023). The African Continental Free Trade Agreement: Unlocking prosperity for Africa. Mondaq. Retrieved May 26, 2025, from https://www.mondaq.com/southafrica/international-trade-investment/1354738/the-african-continental-free-trade-agreement-unlocking-prosperity-for-africa

Pan African Chamber of Commerce and Industry [PACCI]. (2024, June 12). Intra-African trade up 7.2% in 2023, report finds. Retrieved May 26, 2025, from https://www.pacci.org/intra-african-trade-up-7-2-in-2023-report-finds/

Malah Kuete, F. Y. (2023). “Smart” specialisation for enhanced African participation in global value chains. African Economic Conference. https://aec.afdb.org/sites/default/files/papers/smart_specialisation_for_enhanced_african_participation_in_global_value_chains.pdf

Mondaq. (2023, February 21). The African Continental Free Trade Agreement: Unlocking prosperity for Africa. Retrieved May 26, 2025, from https://www.mondaq.com/southafrica/international-trade-investment/1354738/the-african-continental-free-trade-agreement-unlocking-prosperity-for-africa

Mhlanga, O., & Ngepah, N. T. (2023). The impact of artificial intelligence on quality, productivity, workforce transformation and supply chain management in the South African manufacturing sector: A multiple correspondence analysis approach. South African Journal of Economic and Management Sciences, 26(1), Article 5520. https://doi.org/10.4102/sajems.v26i1.5520 (Retrieved May 26, 2025)

Miller, T., Jervis, V., Schoentgen, A., Bensassi-Nour, K., & Kaur, A. (2021, August). Roadmaps for 5G spectrum: Sub-Saharan Africa. GSMA. https://www.gsma.com/connectivity-for-good/spectrum/wp-content/uploads/2023/07/Sub-Saharan-Africa-Roadmaps-for-5G-Spectrum.pdf (Retrieved May 26, 2025)

Nzama, M. L., Epizitone, G. A., Moyane, S. P., Nkomo, N., & Mthalane, P. P. (2024). The influence of artificial intelligence on the manufacturing industry in South Africa. South African Journal of Economic and Management Sciences, 27(1), a5520. https://doi.org/10.4102/sajems.v27i1.5520

Supply Chain World Magazine [SCWM]. (2024, April 12). Transforming Africa's supply chains: The role of AI, blockchain, and IoT. Accessed from: https://scw-mag.com/news/transforming-africas-supply-chains-the-role-of-ai-blockchain-and-iot/ (Retrieved May 26, 2025)

The Palladium Group. (2021, March 31). Four ways blockchain can boost trade in Africa. https://thepalladiumgroup.com/news/Four-Ways-Blockchain-Can-Boost-Trade-in-Africa (Retrieved May 26, 2025)

Topos Magazine. (2022, January 10). Kigali Innovation City masterplan, Rwanda. Available online from: https://toposmagazine.com/kigali-innovation-city-rwanda/ (Retrieved May 26, 2025)

United Nations Industrial Development Organization [UNIDO]. (2020). African manufacturing firms and their participation in global trade. Retrieved May 26, 2025, from https://iap.unido.org/articles/african-manufacturing-firms-and-their-participation-global-trade

White & Case LLP. (2024). Africa Focus: Summer 2024 - Special economic zones. Retrieved May 26, 2025, from https://www.whitecase.com/insight-our-thinking/africa-focus-summer-2024-special-economic-zones

Zeng, D. Z. (2021). The dos and don'ts of special economic zones (Equitable Growth, Finance & Institutions Note). World Bank. Retrieved May 26, 2025, from https://documents1.worldbank.org/curated/en/700061638779538611/pdf/The-Dos-and-Don-ts-of-Special-Economic-Zones.pdf