

Research Article

Unlocking Africa's Regional Trade Potential: Evaluating PIDA and NEPAD Infrastructure Investments on Intra-African Trade Efficiency and Cross-Border Links

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Abstract

Africa's infrastructure shortage, which is estimated to be between \$130 and 170 billion per annum, is a major setback to regional trade integration and attainment of Agenda 2063 goals. In this paper, the researcher examines the impacts of the infrastructure investments made under the New Partnership for Africa Development (NEPAD) and the Programme to Infrastructure Development in Africa (PIDA) on intra-African trade performance in terms of enhancing the performance of cross-border connectivity, corridor efficiency, and trade facilitation mechanisms. Using a qualitative study of institutional reports, implementation statistics of the PIDA Priority Action Plan (PAP) and secondary trade statistics, this research evaluates particular dimensions, such as the relationship between infrastructure and trade costs, performance of the corridors, efficiency of its borders, the influence of ICT digitalization, and impact of energy infrastructure on the competitiveness of manufacturing. Results on ICT infrastructure show significant improvements, having achieved 150 percent of the target, and on transport connectivity, which is 16,066km of roads and 120 One Stop Border Posts. However, there are persistent challenges in terms of transforming infrastructure investments into trade deliverables. The critical gaps are established in limited participation by the private sector (3% in PAP 1), low project bankability (only 25% attaining feasibility), and lack of institutional coordination to facilitate policy harmonization. In spite of the increase in physical connectivity, trade costs and intra-African trade flows are still limited by non-tariff barriers, poor logistics performance, and fragmented regulations, despite showing clear causal links between policy tools and trade outcomes via infrastructure mechanisms. Policy suggestions include improving the NEPAD Infrastructure Project Preparation Facility (IPPF), performance monitoring systems in the corridors, increasing the pace of digital trade facilitation platforms, and creating performance-based incentives towards harmonization of policies between the regions to maximize the trade dividends as a result of infrastructure investments.

Keywords

Cross-Border Connectivity, Infrastructure-Trade Linkages, Intra-African Trade, NEPAD, PIDA, Regional Integration

1. Introduction

The regional integration of trade requires a smooth cross-border infrastructure, which reduces transaction costs, the movement of goods, and improves the connectivity of the supply chain. In Africa, where trade costs are still one of the

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highest in the world, and the intra-African trade amounts only to 15-18% of the entire continent, trade development is not only a developmental necessity, but also a basic condition to realise the trade potential in the region [5]. The African Development Bank has viewed infrastructure as part of the basics on which developments in Africa take its basis. The infrastructure plays a vital role in the development of the continent because it stimulates growth and change, helps in poverty alleviation and the realisation of development objectives [5]. This notwithstanding, there is an astronomical infrastructure deficit in Africa. An enhanced infrastructure would lower the cost of transport, minimise the time and money spent crossing the border, increase the reliability of energy to support the competitiveness of manufacturing, and provide digital platforms to facilitate trade, enabling Africa to achieve the trade dividends envisioned in the African Continental Free Trade Area (AfCFTA).

Infrastructure has been a major concern within the agenda of the African Union (AU), and the Agenda 2063 is simply a vision that strives to transform Africa into a competitive and economically powerful continent by the year 2063 [20, 25]. The infrastructure shortfall in Africa leads to high costs of services, together with low reliability of basic services. This has made Africa continue to hold about 600 million individuals without electricity and about 315 million individuals without clean water (The AUD-NEPAD, 2020). A huge shortfall in infrastructure funding is likely to continue in Africa at between 68 billion and 108 billion US dollars per year [3].

One of the significant challenges to Africa's sustainable development and economic integration is its lack of infrastructure [29]. In some countries, the infrastructure deficit in Africa leads to an estimated annual decline in national economic growth of around 2% and a reduction in productivity of up to 40% [29]. Africa's current institutions responsible for regional and continental infrastructure development include the African Union's New Partnership for Africa's Development (NEPAD) and the Programme for Infrastructure Development in Africa (PIDA).

PIDA was launched in 2010 and adopted in 2012 as a strategic master plan for regional infrastructure development from 2012 to 2040. It is organised around three Priority Action Plans (PAPs): PAP1 (2012-2020), PAP2 (2021-2030), and PAP3 (2031-2040), focusing on cross-border infrastructure projects in four thematic areas: energy, transport, information and communication technology (ICT), and transboundary water resources. PIDA aims to support trade, mobility, and economic integration by connecting markets, facilitating the movement of people and goods, and addressing Africa's critical infrastructure gaps through cross-border projects.

NEPAD aids in resource mobilisation and project preparation through the 5% Agenda Campaign and the Infrastructure Project Preparation Facility (IPPF). Private sector participation in funding PAP1 is extremely low (only 3%), indicating

that new funding avenues are necessary [13]. The article analyses the impact of NEPAD and PIDA on closing the infrastructure investment deficit in Africa. It also examines the results and challenges of their efforts to promote regional integration.

1.1. Institutional Framework: NEPAD and PIDA

The institutionalisation of infrastructure and trade connectivity challenges in Africa is done via the New Partnership for Africa Development (NEPAD) and Programme for Infrastructure Development in Africa (PIDA) by the African Union. Introduced in 2010 and adopted formally in 2012, PIDA is a strategic master plan of regional infrastructural development between the years 2012 and 2040 that is structured around three Priority Action Plans (PAPs): PAP1 (2012-2020), PAP2 (2021-2030), and PAP3 (2031-2040). The framework gives priority to cross-border infrastructural projects under four thematic areas that have direct trade implications, namely energy (to increase manufacturing competitiveness), transport (to increase logistics efficiency), information and communication technology (ICT, to enhance trade digitalisation) and transboundary water resources (to enhance agro-industrial development).

The clear purpose of PIDA is to assist in trade facilitation, mobility, and economic integration by connecting markets, lowering the cost of transactions, and mitigating serious gaps in infrastructure by means of cross-border projects. The framework will focus on achieving certain trade-enabling deliverables, such as the development of corridors, modernisation of border posts, connecting regions through energy and integration of digital customs platforms. NEPAD also supplements PIDA in that it offers resource mobilisation and project preparation instruments, such as the 5% Agenda Campaign and yet another, the Infrastructure Project Preparation Facility (IPPF), which are meant to make project bankability higher and attract private funds towards trade-related infrastructure.

1.2. Research Problem and Significance

Despite considerable financial investments with a mobilisation of \$82 billion under PAP 1, organised respectively by the African Union member states (42%), the Infrastructure Consortium for Africa (24%), China (24%) and other participants, the establishment of infrastructure development as a measure of quantifiable trade outcomes is not sufficiently understood. Although the physical infrastructure metrics reflect the quantifiable improvement, which includes 16,066km of roads built, 120 One-Stop Border posts set up, and 9Tb of broadband connections deployed, the mechanisms by which these investments cut the cost of trade, boost the performance of logistics and improve the intra-African flows need a systematic assessment.

There are still critical knowledge gaps on: (1) the quantitative aspect of the relationship between PIDA infrastructure completion and bilateral trade cost reduction; (2) whether integrated corridor approaches can better ensure the infrastructures are integrated to deliver more efficient supply chains; (3) whether One-Stop Border Posts and ICT infrastructure can help to reduce non-tariff barriers; (4) how institutional coordination can be improved to harmonize the policies across Regional Economic Communities (RECs). In addition, as the involvement of private-sector players (3% in PAP 1) continues to be low, yet the benefits of infrastructure-enabling trade are acknowledged to need commercial investment, it is important to have an insight into the factors that need to be overcome to achieve infrastructure development momentum. In the face of the perceived operational challenges of the PAP 2 implementation and the chronic financing shortfall of \$50-90 million per year, the policy adjustments based on the evidence become inevitable.

The main research question used in this study is: How do PIDA and NEPAD infrastructure investments affect the performance of intra-African trade by enhancing the cross-border connectivity, corridor efficiency, and trade facilitating mechanisms? The aim will be to find out clear causality paths between policy instruments (PIDA projects, NEPAD mechanisms) and infrastructure gains (corridors, borders, connectivity) to particular trade outcomes (cut cost, rise flows, improve performance) that will permit a firm evaluation of the effectiveness of trade integration.

2. Methodology

2.1. Research Design and Approach

Designed to trace policy-mechanism-outcome linkages between infrastructure investments and trade performance, the article entails a qualitative methodological technique founded on document analysis and secondary data, which are retrieved from good AUDA-NEPAD reports, the African Development Bank (AfDB) and different academic literature. By combining trade-relevant measures with institutional performance reports, the research design seeks to create evidence-based links between PIDA/NEPAD initiatives and regional trade integration results.

In this paper, the assessment of certain monetary tools is also being done concerning their rationale in evaluation implication, including the NEPAD 5 % Agenda and the PIDA Services Delivery Mechanism (SDM). Thematic analysis was carried out based on strategies, progress and challenges of NEPAD and PIDA to come up with fundamental themes. Lastly, the data was adjusted with the help of triangulation methods to increase its validity and with regard to the recent statistics of 2020-2025, as this is when the infrastructure investment spending and regional integration projects are following a distinct trend.

2.2. Data Sources and Materials

Reliable institutional papers from AUDA-NEPAD and the African Development Bank (AfDB) make up the main data sources, including:

- 1) PIDA First 10-Year Implementation Report (2012–2022) charting PAP1 project completion rates, investment flows, and sector-specific results
- 2) NEPAD Infrastructure Project Preparation Facility (IPPF) reports on capital mobilisation results and project bankability interventions.
- 3) PIDA Week 2024 stakeholder meetings offering corridor performance evaluations and implementation suggestions
- 4) The Africa Infrastructure Development Index (AIDI) assesses industry progress in relation to goals for 2040.
- 5) African Economic Outlook (2018–2025) reports include trade cost statistics, logistics performance indicators, and manufacturing competitiveness measures.

Among secondary analytical sources are technical assessments from the World Bank Logistics Performance Index Database, Organisations for Economic Co-operation and Development, United Nations Economic Commission for Africa on infrastructure investment effectiveness; comparative regional integration studies (ASEAN Infrastructure Fund, IIRSA); and scholarly publications on infrastructure-trade links. [34, 30, 31].

3. Analysis

3.1. PIDA Trade Integration Design and Strategic Framework

Launched in 2012 with a 2040 completion timeline, PIDA places a premium on trade-enabling infrastructure across four industries: energy (to power manufacturing for export competitiveness), transportation (to lower logistics costs and travel times), ICT (to enable digital customs and trade documentation), and transboundary water resources (to support agro-industrial value chains). It represents a paradigm shift toward unified, cross-border infrastructure development strategies explicitly meant to address Africa's regional trade connectivity gaps [9].

The integrated corridor approach of the framework, which transcends independent national initiatives to create all-encompassing transport-energy-ICT networks connecting landlocked nations to ports, links regional manufacturing centers to consumer markets, and enables flawless cross-border movement systems, is its main innovation. Among flagship initiatives are the Trans-African Highway Network covering 16,066 km of roads and 4,077 km of railways, 120 One-Stop Border Posts meant to cut repetitive customs procedures, and 3,506 km of regional energy transmission lines enabling power trade [11].

3.2. Investment Mobilisation and Project Bankability Performance

3.2.1. PAP1 Financial Outcomes (2012-2020)

PIDA PAP1 consisted of 51 programs with 409 projects with a projected cost of USD 68billion. Real investments mobilised amounted to USD -82billion, more than 21billion above the original targets and it has shown considerable resource -mobilisation potential (AUDA -NEPAD, 2023). The structure of the investment indicates critical structural features:

- 1) Member States of the AU: 42% (USD 34.4 billion) - which implies significant domestic ownership and dedication.
- 2) ICA Members: 24% (USD 19.7 billion) - through the traditional multilateral development bank involvement.
- 3) China: 24% (USD 19.7 billion) - signifies the bilaterality in terms of infrastructure financing.
- 4) Private Sector: 3% (USD 2.5 billion) - reveals deficits in critical mobilisation of capital in commerce.
- 5) Other Sources: 7% (USD 5.7 billion) - representing a variety of philanthropic and new partners.

3.2.2. NEPAD-IPPF Project Preparation Effectiveness

The NEPAD Infrastructure Project Preparation Facility (IPPF) is the main tool of increasing project bankability by conducting feasibility studies, environmental impact assessment, and project structuring facilities. Having an initial capitalisation of USD 118.57 million in grants, IPPF has mobilised USD 11.35 billion in further infrastructure investments, which is a leverage ratio of about 1:96 [13]. Nevertheless, the proportion of PAP1 projects that completed the entire feasibility study throughout the implementation period was lower than 25 percent, which demonstrates that the project preparation capacity is rather limited [32]. In the case of trade infrastructure, where feasibility studies are not complete, there are ripple effects:

- 1) Late financial closure: The investors need thorough risk evaluation before they put in money.
- 2) Cost overruns: Cost increase and technical surprises during construction- technical under preparation.
- 3) Poor design: The lack of demand analysis can lead to corridors which are not based on real trade flows.
- 4) Operational inefficiencies: The absence of an institutional preparedness plan makes facilitation of post-completion trade difficult.

3.3. Infrastructure-Trade Cost Linkages: Sectoral Performance Analysis

Table 1. Africa Infrastructure Development Index (AIDI) Report.

Sector	Achievements	Progress Toward 2040 Targets	Trade Integration Impact
Transport	16,066 km roads, 4,077 km railways, 120 One-Stop Border Posts	52% (roads), 14% (railways)	Reduced transit times; better corridor connectivity; lower transportation costs
Energy	3,506 km transmission lines, 7 GW hydroelectricity	21% (lines), 13% (hydro)	Improved manufacturing reliability; export processing capacity; industrial competitiveness
Water	17,990 million cubic meters transferred (Lesotho Highlands)	1.33% of planned projects	Agro-processing aid; modest trade effect to date
ICT	9 Terabits broadband capacity, 17 countries with fibre cables	150% of the target	Digital customs platforms; electronic documentation; cheaper compliance expenses

Source: [4]

With the help of this table, we are able to get a clear idea of the development of the infrastructure within the areas indicated in Africa. Notably, the ICT sector has so far surpassed its 2040 target by 50% of its target, or to be precise, it has achieved 150% of its target. In other sectors, however, a less significant pace of progress is observed, i.e., water and energy sectors, where only 1.33% and 13%, respectively, of the goals in these sectors were achieved, indicating what needs to be done to achieve the 2040 objectives. PIDA also promotes risk guarantees, blended finance, and public-private partnerships (PPPs) to attract existing private investment [15]. Neverthe-

less, the often-apparent threats to the work of the private sector result in its discouragement, necessitating a significant reduction in risk levels [10].

The project is sustainable and inclusive, delivering on aspects of local ownership and prioritising community interaction [12]. Deniability is established as the ideal influence of investment through cross-sector integrated planning, with attempts to realise both the Agenda 2063 of Africa and the global sustainability agendas [2]. PIDA must overcome the setbacks of cost, implementation, and environmental sustainability to achieve its full potential, which currently holds

back its success in comparison to the advantages in the business and employment sectors.

4. Critical Assessment of NEPAD and PIDA

Although NEPAD and PIDA have been making progress in mobilising resources and laying down strategic plans, a more critical examination would show that there is a lot that is going wrong internally, a lack of power distribution, and malfunctioning accountability measures. An example is NEPAD, which has been accused of having a neoliberal basis, and some of its failures in handling inherited weak states, dysfunctional economies, poor leadership, corruption, and bad governance can be traced to its neoliberal basis [7]. African Peer Review Mechanism (APRM), which aims at supporting good governance, democracy and human rights, has been less effective with voluntary participation and inability to enforce it, hence the disproportionate adoption among member states [16, 18].

These initiatives are also characterised by inequities in power, whereby the strongest external forces are favoured, like excessive dependence on foreign aid (e.g., 70% of the budget of the AU is financed by non-African countries) over African ownership, and continue to create dependency [24]. A lack of coordination, capacity and infighting among member states are structural problems in internal bureaucracies at AUDA-NEPAD, which contribute to implementation delays [14]. There is also poor accountability, including poor transparency in the implementation of the projects and adequate monitoring of funds, which has been reported as a result of which there has been a perception of a funding farce [6, 14, 27].

Moreover, the political goodwill of the member states of the AU is also a key obstacle. Nagging adherence, slow implementation of protocols, delayed decisions (i.e., reforms until 2023 or beyond), and uneven funding contributions have slowed the process [15]. In the case of PIDA PAP2, the fact that it is still in the middle without expedited execution is a clear sign of this noncommittal, which is usually because of the national priorities taking precedence over those of the continent [12].

4.1. PIDA Projects and Their Environmental Impact

In spite of the fact that sustainability is also prioritised within the framework of PIDA, the environmental impacts of big infrastructural developments should be examined in greater detail [35]. The African continent, albeit contributing less than 4% of global emissions of greenhouse gases, is a victim of the impacts of climate change, such as rising droughts, floods, and a rise in sea levels, which may contribute to vulnerability through PIDA initiatives [26, 1]. An ex-

ample is the hydropower schemes of the PIDA project, which include the Bui Dam in Ghana, that have caused changes in river flows, soil composition, and ecosystems, causing loss of biodiversity and disruption of communities. This dam displaced the local communities and aggravated tensions over the available resources, which helped in climate-related migration [19].

The Lesotho Highlands Water Project, which is in the spotlight of Table 1, has moved 17,990 million cubic meters of water into the hands of the ecosystem at the expense of disturbing nature, such as declining downstream water supply and habitat fragmentation, which may have a huge carbon footprint created by deforestation and building operations [22]. On the one hand, the megaprojects threaten to displace communities (e.g., more than 215 million people suffer droughts/floods in 2010-2022) and add to their carbon footprint without low-carbon measures [21]. Climate resilience assessments, as described in World Bank studies [33], should be incorporated in PIDA to deal with these problems beforehand.

4.2. Comparative Analysis of Global Initiatives

In order to compare NEPAD and PIDA, it is possible to compare them with some other regional initiatives to learn some important lessons. The ASEAN Infrastructure Fund (AIF) was set up in 2012, marshalling both public and private debt in Southeast Asian infrastructure, giving a particular focus to blended finance and regional collaboration [8]. Whereas PIDA is heavily dependent on both member states (42%) and external donors, AIF is using multilateral support to increase infrastructure investment as a proportion of GDP (7.5% in South Asia compared to the lower figures in Africa) [30]. It has facilitated the process of project preparation and minimisation of risks, and this implies that PIDA should be able to attract the attention of such specific funds as the Emerging Africa and Asia Infrastructure Fund to generate private capital [30].

The Initiative for the Integration of Regional Infrastructure in South America (IIRSA) started in 2000 and is very similar to PIDA, as both are interested in cross-border trade and integration corridors [17]. But IIRSA has had its share of criticism over its designs towards neoliberalism, whereby export sectors have been of primary concern, resulting in environmental degradation and social displacement, as with PIDA [23]. Among the lessons is the opportunity to balance economic benefits against sustainability, in the context of which IIRSAs are developing to assume the status of green capitalism, with the threat of extractivism [28]. In the case of Africa, the use of integrated planning that is incorporated in IIRSA and improving accountability might curb the cost of power imbalances and environmental expenses [23].

5. Challenges to Effective Trade Integration Through NEPAD and PIDA

Despite its achievements, PIDA and NEPAD encounter rather serious challenges:

- 1) Project Preparation and Implementation capacity: It cannot prepare or implement projects. The limited resources that NEPAD-IPPF has will not be sufficient to develop bankable projects in most countries, and not even all of them. A quarter of the PAP1 projects achieved feasibility, yet they lacked adequate resources [32].
- 2) Financing Gap and Private Capital Mobilization: The financing gap of \$50-90 billion per year needs to be filled, despite the private sector's reluctance due to perceived risks and the lack of definitive feasibility studies. Indeed, the inability to attract investment is essentially because contributions in the private sector in PAP1 stand at 3%, and 19% in India [13].
- 3) Appeal to risk: Projects in African infrastructure are considered risky by investors due to the presence of political instability, corruption, or regulatory uncertainty. This serves to deter the input of private capital, despite the use of instruments such as risk guarantees being in place.
- 4) Institutional Coordination and Policy Harmonization: Fragmented institutional architecture with overlapping mandates creates coordination inefficiencies and slows regulatory harmonization essential for trade facilitation. Physical infrastructure remains underutilized when institutional arrangements fragment. Completed roads connect borders that still impose redundant procedures; energy interconnectors face power purchase agreement disputes.
- 5) Political Will and Commitment Variability: Inconsistent political commitment across Member States and over time creates implementation unpredictability and undermines long-term planning. Trade integration requires sustained, coordinated commitment across multiple countries over extended periods (infrastructure projects span 5-15 years). Political will fluctuations create stop-start patterns that increase costs, delay benefits, and deter private investors who require predictable policy environments.
- 6) Sustainability and Inclusivity: It is another reality that PAP2 gives impetus to gender-sensitive and sustainable projects; nonetheless, its implementation is quite slow. Large-scale plans are usually related to the risk of displacement of people by environmental effects.

The PAP2 takes account of such concerns by means of the Integrated Corridor Approach as well as tools like the PIDA Quality Label (PQL), which encourages the excellence of projects.

6. Conclusion and Policy Recommendation

NEPAD and PIDA are among the most ambitious projects in Africa, focusing on addressing infrastructure challenges and promoting regional integration. These frameworks have recorded significant achievements over the last ten years, including raising investments amounting to 82 billion dollars in the PAP1 projects, with international partners and Member States of the African Union (42%) and external partners, including China, making significant contributions. In the 10-Year Progress Report, it is noted that 73% of PAP1 projects have reached the stage of moving the project to operational levels, especially in ICT, where 150% targets have already been exceeded, and the prospects of achieving quick advances in the digital connectivity are bright.

Despite the progress achieved in discovering strategic projects and winning favour, the analysis shows that there are issues that persistently prevent achieving all these objectives. Project implementation is still hampered by internal inefficiencies, which include bureaucratic processes, capacity constraints, and poor accountability systems, among others. The dependency caused by power relations that prefer external sources of money and the inability of the political will of the states being members of the UK (in terms of disproportionality of donations and the gradual acceptance of protocols) increases fragmentation. The effects caused on the environment, such as the disturbance of the ecosystem and the displacement of the community by the project, such as the hydropower dams, underscore the greater sustainability that is being put in place in the face of the susceptibility to climate change in Africa.

Innovative financing is not the solution alone, because it is also important to identify means to fill the infrastructure investment gap, using aspects such as political commitment, capacity building, and more coordination. The insights that have been shared globally, such as the Infrastructure Fund by ASEAN and IIRSA in Latin America, underline the need to implement blended finance, risk reduction, and balanced planning to eliminate such obstacles. Mobilisation of climate finance by events like the PIDA Roundtable, as well as the Luanda Financing Summits, are promising options to fill in the \$130-170 billion/year infrastructure gap.

7. Summary of Key Findings

This study investigated how PIDA and NEPAD infrastructure investments influence intra-African trade performance through cross-border connectivity, corridor efficiency, and trade facilitation mechanisms. The analysis reveals a complex picture of meaningful progress accompanied by persistent constraints that limit the translation of infrastructure hardware into trade integration outcomes.

Primary Achievements:

- 1) *Substantial Investment Mobilization:* PIDA PAP1 mo-

bilized USD 82 billion (21% above targets), demonstrating considerable resource generation capacity despite financing gaps. This investment represents a significant down payment on Africa's estimated \$130-170 billion annual infrastructure deficit.

- 2) *Physical Connectivity Expansion*: Completion of 16,066 km of roads (52% of 2040 targets), 4,077 km of railways (14%), 120 One-Stop Border Posts, 3,506 km of power transmission lines (21%), and 9 Terabits of ICT broadband capacity (150% achievement) creates tangible foundations for enhanced trade integration.
- 3) *Digital Infrastructure Leadership*: ICT sector performance exceeding targets by 50% positions Africa for digital trade participation, enabling customs automation, electronic documentation, and supply chain visibility improvements that reduce non-tariff barriers.
- 4) *Corridor Integration Framework*: The integrated corridor approach establishes systems-level planning that transcends standalone projects, creating comprehensive transport-energy-ICT networks serving trade flows.
- 5) *Project Bankability Mechanisms*: NEPAD-IPPF's 1:96 leverage ratio and PIDA Quality Label standards create institutional frameworks for sustained project preparation, demonstrating potential for systematic bankability enhancement.

Critical Constraints:

- 1) *Infrastructure-Trade Outcome Gap*: Despite physical connectivity improvements, measurable trade cost reductions and intra-African trade volume increases remain modest. Continental average LPI scores improved minimally (2.41 to 2.57), suggesting infrastructure hardware alone is insufficient without complementary institutional reforms.
- 2) *Project Preparation Deficits*: Only 25% of PAP1 projects achieved complete feasibility studies, creating cascading implementation delays, cost overruns, and investor deterrence. This preparation gap represents a critical bottleneck limiting infrastructure delivery pace.
- 3) *Private Capital Mobilization Failure*: 3% private sector participation in PAP1 financing exposes fundamental issues in project structuring, risk allocation, and investment climate that constrain commercial capital engagement despite infrastructure's inherent revenue-generating potential.
- 4) *Institutional Coordination Fragmentation*: Overlapping mandates among AUDA-NEPAD, RECs, and national governments create decision delays (adding 12-18 months to timelines), policy inconsistencies, and accountability diffusion that undermine implementation effectiveness.
- 5) *Regulatory Harmonization Deficit*: Physical infrastructure remains underutilized when institutional arrangements fragment—completed roads connect borders imposing redundant procedures, OSBPs operate within unharmonized regulatory frameworks, and energy in-

terconnectors face power purchase disputes.

- 6) *Sustainability Integration Gaps*: Inadequate climate resilience assessments, environmental safeguard enforcement, and social inclusion mechanisms generate infrastructure vulnerability (climate disruptions), community opposition (displacement without compensation), and sustainability concerns (carbon footprints) that undermine long-term effectiveness.
- 7) *Political Will Variability*: Inconsistent protocol ratification, irregular financial contributions, and PAP2 implementation stagnation reveal commitment gaps that create unpredictability, deter investment, and slow infrastructure delivery.

8. Theoretical Contributions

The study contributes to infrastructure-trade integration scholarship by:

- a) *Disaggregating Infrastructure Types*: Demonstrating differential trade impacts across sectors (ICT exceeding expectations, energy lagging critically) that require tailored policy approaches rather than uniform infrastructure strategies.
- b) *Highlighting Institutional Complementarities*: Establishing that physical connectivity is necessary but insufficient—regulatory harmonization, border procedure coordination, and political commitment determine whether infrastructure translates into trade flows.
- c) *Quantifying Bankability Constraints*: Documenting that project preparation deficits (75% incompleteness) represent binding constraints more critical than absolute financing availability, shifting policy focus toward preparation capacity enhancement.
- d) *Mapping Political Economy Barriers*: Revealing how sovereignty sensitivities, national-regional priority tensions, and external dependency dynamics create implementation obstacles requiring explicit governance solutions beyond technical infrastructure design.
- e) *Integrating Sustainability Dimensions*: Demonstrating that climate vulnerability, environmental costs, and social displacement risks represent not peripheral concerns but central threats to infrastructure effectiveness and long-term trade integration sustainability.

9. Practical Policy Options

The proposed policy action on increasing investments in infrastructure involves:

- a) *Nurturing an enabling regulatory environment*, encouraging participation of the private sector and guaranteeing transparency of the project execution process.
- b) *The African Union must attempt to standardise trans-boundary policies to facilitate the implementation*

of trans-boundary projects, tackle regional challenges, and establish a regional investment fund designed to encourage first-time capital inflows in high-priority infrastructure projects.

- c) Educating local professionals to work in project management and engineering sectors is a way to reduce the need for foreign skills and increase the sustainability of infrastructure developments. This can be made through regional workshops and training programs.
- d) The creation of working groups comprising government, private sector, and civil society members, to engage in more dialogues. These groups should convene regularly to address specific sector challenges, such as water investments, and incorporate community feedback to ensure inclusivity
- e) Add greater sums to feasibility studies using the NEPAD-IPPF, which has tapped into USD 11.35 billion out of a USD 118.57 million grant [12]. Expanding this facility with additional grants from multilateral partners could accelerate the preparation of bankable projects
- f) Utilise finance risk mitigation instruments, such as the Africa Infrastructure Guarantee Mechanism, to encourage the attraction of private investment [11]. This should be coupled with climate finance mobilisation strategies, as emphasised in recent PIDA actions, to address environmental risks
- g) Enhance accountability through mandatory APRM reviews and address political will by incentivising member states with performance-based funding. This could include tying funding allocations to demonstrated progress in protocol adoption and contributions.
- h) Strengthen institutional coordination by addressing fragmentation through dedicated task forces between AUDA-NEPAD, RECs, and Member States, as highlighted in ongoing challenges.
- i) Integrate environmental impact assessments into all projects, learning from global models like IIRSA's sustainability adjustments, to minimise displacement and emissions. Additionally, develop climate-resilient guidelines, building on PISP's Climate-Gender-Youth frameworks, and prioritise low-carbon technologies in the energy and transport sectors.

Abbreviations

ADBG	African Development Bank Group
AfCFTA	African Continental Free Trade Area
AfDB	African Development Bank
AIDI	Africa Infrastructure Development Index
AIF	ASEAN Infrastructure Fund
APRM	African Peer Review Mechanism
ASEAN	Association of Southeast Asian Nations
AU	African Union
AUDA	African Union Development Agency
ICT	Information and Communication Technology

IIRSA	Initiative for the Integration of the Regional Infrastructure of South America
IPPF	Infrastructure Project Preparation Facility
LPI	Logistics Performance Index
NEPAD	New Partnership for Africa's Development
OECD	Organisations for Economic Co-operation and Development
PAP	PIDA Priority Action Plans
PIDA	Programme for Infrastructure Development in Africa
PPPs	Public-Private Partnerships
PQL	PIDA Quality Label
REC	Regional Economic Community
SDM	Services Delivery Mechanism
UNECA	United Nations Economic Commission for Africa

Author Contributions

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