



The Electric Paradox: Navigating Potential and Paralysis in Nigeria's E-Mobility Transition

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ABSTRACT

This paper analyzes the viability and strategic imperatives of electric vehicle (EV) adoption in Nigeria, a major hydrocarbon-exporting nation contending with significant energy infrastructure deficits and severe urban pollution. The global transition towards e-mobility presents a fundamental paradox for Nigeria, whose economy is deeply intertwined with the fossil fuels that electrification seeks to displace. Through a critical review of contemporary research and a bibliometric analysis of the African e-mobility academic landscape, this study deconstructs the systemic impediments to Nigeria's transition, which are categorized as socio-economic, infrastructural, and governmental. The findings indicate that these barriers collectively render widespread EV adoption untenable under current conditions. A bibliometric analysis reveals Nigeria's peripheral role in the continental e-mobility discourse, signifying a critical knowledge and policy gap. Conversely, the analysis identifies a clear, data-driven trajectory for progress by aligning with the continent's emerging research frontiers. Three strategic pathways are proposed to catalyze a pragmatic transition: (1) prioritizing the electrification of the high-impact two and three-wheeled commercial vehicle segment (paratransit); (2) developing decentralized charging infrastructure powered by Nigeria's abundant solar resources to bypass national grid limitations; and (3) establishing a circular economy model for the EV battery value chain to foster industrial development and mitigate environmental risks. The paper concludes that the primary determinant for Nigeria's e-mobility success is not technological feasibility but the implementation of a decisive, integrated, and phased policy framework. Without such a framework, Nigeria risks becoming a passive recipient of foreign EV technology and a disposal site for used internal combustion engine vehicles, rather than an active architect of a sustainable and economically diversified transport system.

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INTRODUCTION

The Global Energy Transition and Nigeria's Economic Crossroads

The 21st century is defined by a global energy transition, characterized by a systemic shift away from fossil fuels towards renewable energy sources and sustainable technologies, driven by climate change imperatives and

technological innovation (Agyekum et al., 2023; Ayetor, Mashele, et al., 2023). For Nigeria, Africa's largest economy and a quintessential petro-state, this global megatrend presents a profound and existential challenge. The nation's economic architecture, public finances, and geopolitical standing have been historically predicated on the extraction and export of crude oil (Ahjum et al., 2018). Consequently, the global pivot towards

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electric mobility (e-mobility) constitutes a direct disruption to this longstanding economic model, creating a fundamental paradox: the nation must contemplate a future powered by a technology that aims to supplant its primary source of revenue.

This transition is not a distant prospect but an accelerating reality. As nations across the globe legislate phase-out dates for internal combustion engine (ICE) vehicles and invest heavily in EV ecosystems, the long-term demand for oil in the transport sector faces structural decline. For Nigeria, this necessitates an urgent strategic re-evaluation, moving beyond a reactive posture to proactively chart a course for economic diversification and energy independence.

The imperative is thus twofold: defensive, to mitigate the economic shocks of declining oil revenue; and offensive, to capitalize on the industrial and technological opportunities inherent in the new energy economy (Egbue & Long, 2012). The question is no longer whether a shift to electric vehicles will occur, but how a nation like Nigeria can navigate this transition to foster sustainable development, rather than becoming a casualty of it. The broader African context underscores this urgency, with a growing body of research exploring how the continent can leverage the e-mobility shift to fast-track a wider energy transition and achieve net-zero ambitions (Ayetor, Mashele, et al., 2023).

The Urban Transport Crisis: Pollution, Congestion, and Economic Drag

The strategic imperative for an e-mobility transition in Nigeria is magnified by a severe and worsening urban transport crisis. Major metropolitan areas, particularly Lagos, Abuja, and Port Harcourt, are afflicted by chronic traffic congestion, and hazardous levels of air and noise pollution, largely attributable to a vehicle fleet dominated by aging, poorly maintained, and inefficient ICE vehicles (Kalghatgi, 2018). This reliance on a fossil-fuel-based transport system

imposes immense public health and economic costs. Air pollution from vehicle emissions is a leading cause of respiratory illnesses, while incessant noise pollution contributes to a range of health issues.

Economically, the hours lost to traffic congestion represent a significant drain on productivity, and the nation's heavy dependence on imported petroleum products creates persistent macroeconomic vulnerability (Ahjum et al., 2018). The goal of achieving zero vehicle emissions, while ambitious, is a critical objective for improving public health, enhancing urban livability, and fostering economic resilience. The challenges faced in Nigeria are analogous to those in other rapidly urbanizing African nations, where the need to decarbonize the transport sector is a shared priority. Adopting electric mobility, therefore, is not merely an environmental choice but a strategic tool for addressing these deep-seated urban and economic maladies. It offers a pathway to decouple urban growth from environmental degradation and to build a more efficient, healthier, and sustainable transport paradigm.

A Peripheral Player: Situating Nigeria in the African E-Mobility Research Landscape

Despite the clear and pressing need for a transition, Nigeria's engagement with the e-mobility revolution has been demonstrably lagging, not only in policy and implementation but also in knowledge production. A bibliometric analysis of scholarly output on electric vehicles across Africa reveals a stark disparity that positions Nigeria on the periphery of the continent's intellectual discourse on the subject. As shown in Table 1, South Africa has established itself as the undisputed research leader, with 44 publications generating 388 citations. In stark contrast, Nigeria has produced only 3 documents with a mere 5 citations, placing it behind smaller economies like Ghana and Rwanda in terms of research engagement.

Table 1: Top African countries with research on EV

Country	Documents	Citations	Avg. pub. Year	Links	Total link strength
South Africa	44	388	2019	8	70

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Country	Documents	Citations	Avg. pub. Year	Links	Total link strength
Ghana	4	98	2022	3	32
Nigeria	3	5	2022	1	2
Uganda	3	37	2016	1	16
Egypt	2	128	2012	1	1
Rwanda	2	33	2023	3	29
Zambia	2	7	2014	1	8
Botswana	1	2	2024	3	11
Namibia	1	12	2013	1	7

This quantitative gap is not merely an academic footnote; it is a leading indicator of a deeper policy and knowledge deficit. The bibliographic coupling map, visualized in Figure 1, further illustrates this point by mapping the intellectual connections between research produced by different African nations. The map depicts South Africa as the central, dominant

nexus of the network, with numerous strong connections to other research clusters. Nigeria, however, is relegated to an isolated node with a single, tenuous link, signifying its profound disconnection from the continent's primary e-mobility research community.

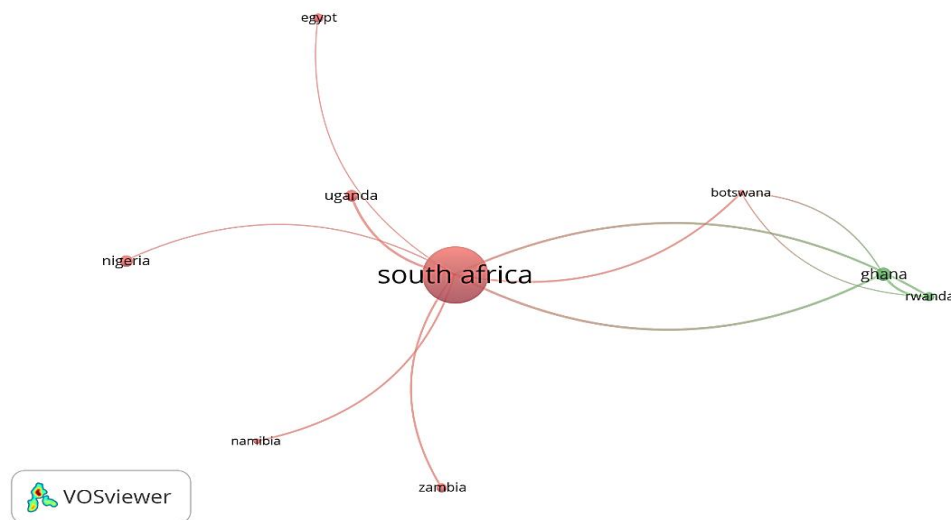


Figure 1: Bibliographic Coupling of African countries with research on EV

This isolation has severe practical consequences. The lack of a robust domestic research ecosystem means that Nigerian policymakers, investors, and entrepreneurs lack access to context-specific data, analysis, and expertise necessary to inform a complex socio-technical transition. Without this foundational knowledge, policy formulation is more likely to be

based on ill-fitting models imported from vastly different European or Asian contexts, increasing the risk of costly missteps. Nigeria's peripheral position is therefore not a passive symptom of inaction but an active cause of future policy failure, perpetuating a cycle of paralysis by reinforcing the knowledge vacuum that inhibits evidence-based decision-making.

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Argument and Contribution: From Paralysis to a Pragmatic, Phased Transition

This paper argues that overcoming Nigeria's e-mobility paralysis requires a fundamental strategic shift. It must move beyond a simple catalog of challenges and opportunities to embrace a pragmatic, phased, and locally contextualized transition strategy. This strategy must consciously diverge from the passenger-car-centric models of the Global North and instead focus on solutions tailored to Nigeria's unique socio-economic and infrastructural realities.

The primary contribution of this paper is to provide an evidence-based foundation for such a strategy. By analyzing the intellectual structure of African e-mobility research, it demonstrates that the most pragmatic path for Nigeria aligns directly with the cutting-edge of continental research, which is increasingly focused on electrifying paratransit, integrating decentralized solar power, and developing circular economy models. This paper reframes the e-mobility challenge in Nigeria, positioning it not as a question of technological or financial feasibility, but as a test of political will and policy imagination. It provides a clear, actionable framework to guide Nigeria from its current state of systemic gridlock toward a future as an active architect of a sustainable transport system.

Deconstructing the Systemic Gridlock: Barriers to EV Adoption in Nigeria

The potential for a vibrant e-mobility sector in Nigeria is currently stalled by a tripartite gridlock of interconnected failures. These systemic barriers, spanning the socio-economic, infrastructural, and governmental domains, create a self-reinforcing cycle of inertia that renders widespread EV adoption untenable under present conditions. A systematic deconstruction of these barriers is essential to formulating an effective strategy for progress.

The Socio-Economic Impasse: Affordability, Financing, and Consumer Perceptions

The most immediate and formidable barrier to EV adoption in Nigeria is the prohibitive upfront cost of new electric vehicles (Farinloye et al., 2024). The Nigerian automotive market is

overwhelmingly dominated by the importation of affordable, used ICE vehicles, which serve the mobility needs of the vast majority of the population (Bawa & Nwohu, 2023). In this context, the price point of a new EV, which is often multiples of the cost of a comparable used ICE vehicle, represents an insurmountable financial hurdle for most individuals and businesses. This cost disparity is the central friction point in the market, creating a significant gap between the long-term economic and environmental benefits of EVs and the immediate financial reality of consumers.

This primary cost barrier is compounded by a series of secondary financial anxieties and market failures. Chief among these is the high perceived cost of battery replacement, a concern that weighs heavily on potential adopters given the lack of clear warranties, service networks, and end-of-life solutions for EV batteries in the country (Chigbu et al., 2024). Furthermore, the financial sector has yet to develop tailored financing models, such as leasing programs or loans that account for the lower total cost of ownership (TCO) of EVs, leaving potential buyers without viable pathways to manage the high initial capital outlay.

These economic factors are interwoven with critical psychological barriers related to consumer attitudes and perceptions (Egbue & Long, 2012). Research from other emerging economies confirms that while consumers may acknowledge the environmental benefits of green innovations, their purchasing decisions are primarily driven by pragmatic concerns: cost, utility, reliability, and convenience (Dilotsothe, 2022; Egbue & Long, 2012). In South Africa, for instance, detailed studies have identified these same socio-economic factors as the principal impediments to EV adoption, highlighting the commonality of these challenges across major African markets (Moeletsi, 2021). Without addressing these fundamental consumer realities through targeted incentives, accessible financing, and robust public education campaigns, the demand for EVs in Nigeria will remain confined to a negligible niche market.

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The Infrastructure Paradox: Grid Fragility versus Solar Abundance

Nigeria's infrastructure landscape presents a classic paradox that is central to its e-mobility challenge. On one hand, the centralized national electricity grid is notoriously inadequate and unreliable, characterized by frequent outages and an overall generation capacity that is insufficient for the country's existing needs (Ayeter, Mashele, et al., 2023). The prospect of adding the significant, concentrated load of a large EV fleet onto this already fragile system seems untenable and irresponsible. Studies on the grid impact of EV charging, even in contexts with far more stable power systems like South Africa, demonstrate the potential for significant strain on low-voltage distribution networks, underscoring the magnitude of this challenge for Nigeria (Abraham et al., 2021). This grid fragility represents a powerful and legitimate argument against a conventional, grid-dependent EV charging model.

On the other hand, this critical weakness is counterbalanced by one of the nation's greatest and most underutilized strengths: its immense solar energy potential (Abdallah & Elshennawy, 2013). With high levels of solar irradiation across the country, Nigeria is perfectly positioned to leapfrog the limitations of its centralized grid by embracing decentralized, renewable energy solutions. This opens a clear strategic pathway for a model of "swarm electrification" which is the development of a distributed network of off-grid or grid-tied solar-powered charging stations (Sheridan et al., 2023). In the long term, the integration of EVs with smart grid technologies presents a further opportunity to transform a potential liability into an asset.

Through Vehicle-to-Grid (V2G) applications, a fleet of EVs could function as a vast, distributed network of mobile batteries, storing excess solar energy during the day and discharging it to support the grid during peak demand periods. This approach could help stabilize power systems, facilitate higher penetration of intermittent renewables, and reduce overall emissions from the electricity sector, turning the challenge of EV charging into a

solution for grid modernization (Abdallah & Elshennawy, 2013).

The Governance Vacuum: The High Cost of Inaction

While socio-economic and infrastructural barriers are significant, perhaps the most profound impediment to Nigeria's e-mobility transition is the persistent policy and governance vacuum. At present, Nigeria lacks a comprehensive and coherent National Electric Vehicle Policy, a foundational document necessary to signal government commitment, define a strategic direction, and provide regulatory certainty to the market (Farinloye et al., 2024). This absence of a clear policy roadmap creates a crippling environment of uncertainty that deters long-term investment from both domestic and international actors, stalls innovation, and leaves consumers and businesses in a state of limbo.

This policy inertia is not a passive oversight but an active, market-distorting signal. By failing to provide a clear regulatory framework for e-mobility, the government inadvertently derisks the status quo, the well-established business of importing and servicing used ICE vehicles, while simultaneously elevating the perceived risk for any potential investor in the nascent EV ecosystem. This inaction functions as a de facto subsidy for the incumbent fossil-fuel-based transport system and a tax on innovation, actively perpetuating the very problem the government claims it wants to solve. The high cost of this inaction is measured in lost investment, delayed technological adoption, and a ceded competitive advantage to more proactive nations on the continent (Ayeter et al., 2020).

A robust policy framework is also essential to ensure that the transition is just and equitable. Without deliberate policy interventions to manage the shift, the benefits of e-mobility could accrue to a small, wealthy segment of the population while the negative consequences, such as job losses in the traditional automotive repair sector, are borne by the most vulnerable (Ayeter, Mbonigaba, et al., 2023). An unmanaged transition risks deepening existing social and economic inequalities (Raman et al., 2025). The

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development of a clear roadmap, such as those being implemented in countries like South Africa, is a prerequisite for progress, providing the structure needed to coordinate public and private sector efforts, manage equity considerations, and unlock the nation's e-mobility potential (Vanegas Cantarero, 2020).

Charting a Viable Course: Aligning Strategy with Continental Research Trends

To move from systemic gridlock to sustainable progress, Nigeria must adopt a strategic approach that is both pragmatic and evidence-based. A departure from conventional, car-centric EV strategies is required in favor of a pathway tailored to the nation's specific context. Crucially, this analysis reveals that the most viable course for Nigeria aligns directly with the core focus and emerging trends of e-mobility research across the African continent. By leveraging

insights from the continental research landscape, Nigeria can formulate a strategy that is not speculative but is grounded in the intellectual trajectory of African-led innovation.

The Intellectual Structure of African E-Mobility Research

A bibliometric analysis of the keywords used by authors in African e-mobility research provides a powerful, data-driven map of the field's intellectual structure and evolution. This analysis reveals where the continent's top researchers are focusing their efforts and what they consider to be the most pressing and promising areas of inquiry. The co-occurrence map of author keywords, visualized in Figure 2, shows that the central node of 'electric vehicle (ev)' is most strongly and frequently linked to practical, solution-oriented concepts such as 'renewable energy', 'solar power', 'paratransit', and 'minibus taxi'.

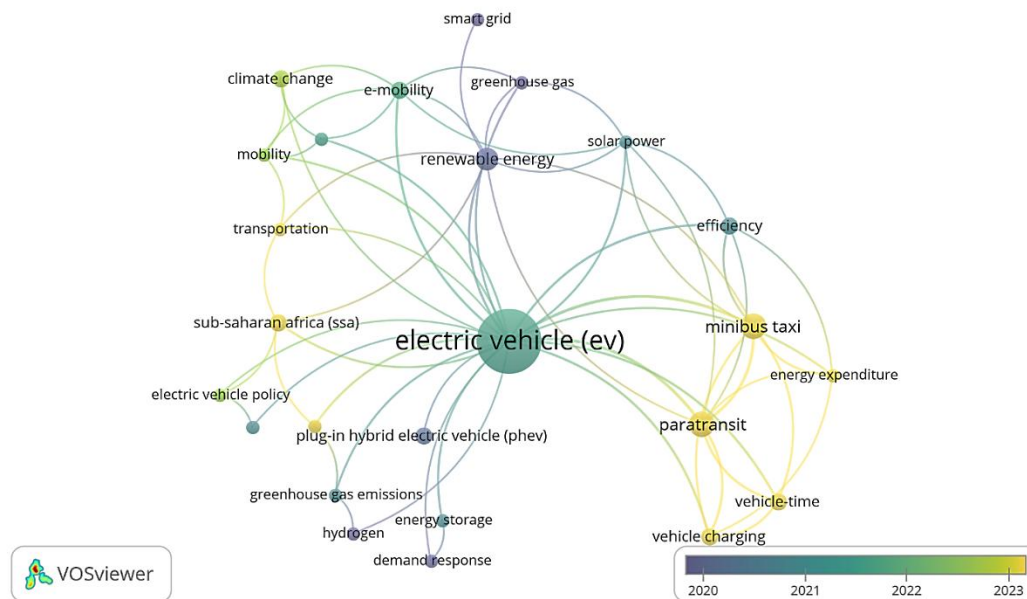


Figure 2: Co-occurrence of author keywords in EV research in Africa

This finding is reinforced by the data presented in Table 2 and Table 3. Table 2, which lists the most highly cited documents in the field, shows that recent, influential research is

dominated by topics such as solar charging for paratransit, the feasibility of electric two and three-wheelers, and battery swapping solutions for minibus taxis.

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Table 2: Top documents on EV in Africa

Document	Title	Cited by	Document Type
(Abdallah & Elshennawy, 2013)	Reducing carbon dioxide emissions from electricity sector using smart electric grid applications	128	Review
(Ayetor et al., 2020)	Towards zero vehicle emissions in Africa: A case study of Ghana	55	Article
(Bokopane et al., 2024)	Optimal power dispatching for a grid-connected electric vehicle charging station microgrid with renewable energy, battery storage and peer-to-peer energy sharing	48	Article
(Hoffmann, 2019)	On the outlook for solar thermal hydrogen production in South Africa	48	Article
(Moeletsi, 2021)	Socio-economic barriers to adoption of electric vehicles in South Africa: Case study of the gauteng province	34	Article
(Abraham et al., 2021)	Ray of hope for sub-Saharan Africa's paratransit: Solar charging of urban electric minibus taxis in South Africa	33	Article
(Ben Arab et al., 2022)	Suitable various-goal energy management system for smart home based on photovoltaic generator and electric vehicles	25	Article
(Ayetor, Mbonigaba, et al., 2023)	Feasibility of electric two and three-wheelers in Africa	18	Article
(Ahjum et al., 2018)	Road transport vehicles in South Africa towards 2050: Factors influencing technology choice and implications for fuel supply	17	Article
(Giliomee & Booysen, 2023a)	Decarbonising South Africa's long-distance paratransit: Battery swapping with solar-charged minibus trailers	16	Article

Table 3 further quantifies this trend, showing that 'minibus taxi' and 'paratransit' are the most frequently occurring specific keywords after the general term 'electric vehicle (ev)'. Critically, the average publication year for these keywords is 2023, the most recent in the dataset, indicating that this is the current research frontier. The color

overlay in the keyword map (Figure 2) visually confirms this temporal shift: older research, shown in blue, focused on broader topics like 'greenhouse gas', while the most recent research, clustered in yellow, is concentrated around 'paratransit' and 'minibus taxi'.

Table 3: List of top author keywords by occurrence in EV research in Africa

Keyword	Occurrences	Avg. pub. year	Links	Total link strength
electric vehicle (ev)	28	2021	23	52
minibus taxi	6	2023	8	21
paratransit	6	2023	8	21
renewable energy	5	2020	9	11

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Keyword	Occurrences	Avg. pub. year	Links	Total link strength
climate change	3	2023	4	4
e-mobility	3	2022	7	9
efficiency	3	2021	5	8
plug-in hybrid electric vehicle (phev)	3	2020	1	1
sub-saharan africa (ssa)	3	2023	5	6
vehicle charging	3	2024	5	11

This bibliometric evidence provides a powerful, non-obvious justification for the strategic pathways proposed for Nigeria. The recommendations are not merely "good ideas" but represent a direct alignment with the continent's most promising, peer-vetted, and contextually relevant research frontiers. This data-driven approach elevates the proposed strategy from opinion to an evidence-based course of action, charting a path for Nigeria that leverages the collective intelligence of the African research community.

Strategic Pathway I: Prioritizing the Two and Three-Wheeler Commercial Segment

Based on the evidence from the continental research landscape and the realities of Nigeria's urban transport system, the most logical, impactful, and economically viable starting point for electrification is not the private passenger car, but the millions of commercial motorcycles (*okadas*) and tricycles (*keke napeps*) that form the backbone of urban and peri-urban mobility. These vehicles are a key form of paratransit, the very sector identified as a trending research topic in the bibliometric analysis.

The case for prioritizing this segment is compelling on multiple fronts. First, these vehicles are major sources of urban air and noise pollution, meaning their electrification would yield immediate and significant public health and environmental benefits. Second, their high daily mileage and intensive usage patterns create a strong economic case for electrification. The substantial savings on fuel and maintenance costs can offset the higher upfront purchase price relatively quickly, making the TCO for an electric version highly competitive, if not superior, to its ICE counterpart. Third, the

operational model of these vehicles, which often involves returning to a central depot or operating within a defined geographical area, simplifies the initial rollout of charging infrastructure.

Recent studies have specifically affirmed the technical and economic feasibility of electrifying two and three-wheelers in the African context, providing a solid academic foundation for this strategic focus (Ayeter, Mbonigaba, et al., 2023). A conceptual framework for the adoption of electric motorcycles for ride-hailing services has already been developed for a megacity like Lagos, demonstrating that this pathway is not only logical but also actionable (Waluyo et al., 2022). By focusing on this segment, Nigeria can achieve rapid, high-impact results, build local capacity in assembly and maintenance, and create a foundation of success upon which a broader e-mobility transition can be built.

Strategic Pathway II: Harnessing Solar Potential through Decentralized Charging Infrastructure

To overcome the formidable barrier of the unreliable national grid, Nigeria's e-mobility strategy must be intrinsically linked to its most abundant renewable energy resource: solar power. This corresponds directly to the strong linkage between 'electric vehicle' and 'solar power' identified in the analysis of African research keywords. The most viable approach is to bypass the fragile centralized grid by developing a distributed network of decentralized charging stations powered primarily by solar photovoltaics (PV).

This strategy of "swarm electrification" involves creating numerous small-scale, independent charging points, which could range

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from small, off-grid battery swapping stations for electric motorcycles to larger, grid-tied microgrids with battery storage for charging electric minibuses and cars. This approach offers several distinct advantages. It directly addresses the grid reliability issue, making EV adoption feasible even in areas with poor or non-existent grid access. It leverages a domestic, inexhaustible energy source, reducing dependence on imported fossil fuels and enhancing national energy security. It also creates significant opportunities for local entrepreneurship, allowing small and medium-sized enterprises to own and operate charging stations.

The viability of this model is strongly supported by leading research from across the continent. Studies from South Africa have demonstrated the technical feasibility and economic promise of solar-powered charging for urban electric minibus taxis and have explored innovative models like battery swapping with solar-charged trailers for long-distance paratransit (Abraham et al., 2023). These African-led innovations provide a clear and proven blueprint that Nigeria can adapt and scale. By embracing a solar-centric, decentralized charging strategy, Nigeria can transform its greatest infrastructural weakness into a catalyst for a resilient, renewable-powered transport system.

Strategic Pathway III: Building a Circular Economy for the Battery Value Chain

A forward-thinking e-mobility strategy cannot treat the EV battery as a simple component; it must be viewed as a critical national asset and the cornerstone of a new industrial sector. The high cost, limited lifespan, and environmental impact of batteries necessitate the adoption of a circular economy model from the outset (Lacock et al., 2023). This involves creating a comprehensive national ecosystem for the entire battery lifecycle, transforming a potential challenge into a significant economic and environmental opportunity.

This strategy should be built upon the principles of the "4Rs":

1. Repair: Developing local technical capacity to diagnose and repair faulty

battery packs, extending their operational life in vehicles.

2. Repurposing: Establishing facilities to take retired EV batteries that no longer meet the rigorous demands of automotive use and give them a "second life" in less demanding applications, such as stationary energy storage for homes, businesses, or solar charging stations. This creates a valuable new product from a waste stream and helps to lower the cost of renewable energy systems.
3. Remanufacturing: Creating industrial capacity to disassemble used battery packs, test and grade individual cells, and reassemble them into new packs for various applications. This is a key focus of circular economy research and is essential for maximizing resource value.
4. Recycling: Investing in advanced recycling technologies to recover valuable raw materials like lithium, cobalt, and nickel from batteries at their absolute end-of-life, reducing reliance on imported primary materials and mitigating the environmental hazards of disposal.

By proactively building this circular economy, Nigeria can capture a significant portion of the EV value chain, creating skilled jobs in engineering, manufacturing, and logistics. It addresses consumer anxiety about battery replacement costs by creating a market for used batteries and ensures that the transition to e-mobility does not create a new environmental problem of hazardous battery waste. This strategic focus on the battery value chain is essential for ensuring that Nigeria becomes a producer and innovator in the e-mobility space, rather than merely a consumer of imported technology.

An Integrated Policy Framework for a Just Transition

The strategic pathways outlined above can only be realized through a decisive, coherent, and integrated policy framework. This framework must be implemented in strategic phases to build

momentum, derisk investment, and manage the complex political economy of the transition. A phased approach allows for the creation of a supportive ecosystem and the development of a domestic pro-EV coalition before tackling the more entrenched interests of the incumbent ICE vehicle industry.

Phase I (2025-2028): Enable the Commercial and B2B Ecosystem

The initial phase should focus on stimulating the market where the economic case is strongest and the barriers are lowest: the business-to-business (B2B) and commercial transport sectors, particularly the two and three-wheeler segment. The policy objective is to catalyze early adoption and build foundational infrastructure with minimal direct cost to the public treasury. Key policy actions should include:

1. Fiscal Incentives: Complete waiver of import duties, value-added tax (VAT), and other levies on fully-built electric motorcycles and tricycles, as well as on their semi-knocked-down (SKD) and completely-knocked-down (CKD) kits to encourage local assembly.
2. Infrastructure Support: Removal of all duties and taxes on charging equipment, battery swapping stations, and related components to accelerate the build-out of a decentralized charging network.
3. Pilot Programs: Launching government-supported pilot programs in partnership with major transport unions, logistics companies, and delivery services to demonstrate the viability and TCO benefits of electric two and three-wheelers in real-world conditions.
4. Priority Licensing: Offering preferential registration and licensing terms for commercial electric fleets.

This phase is designed to be non-threatening to the mainstream passenger car market. Its primary goal is to create a new set of economic stakeholders—local assemblers, charging station operators, e-mechanics, and fleet

owners—who will form the nucleus of a domestic e-mobility industry.

4.2 Phase II (2029-2032): Scale and Localize

With a foundational ecosystem in place, the second phase should focus on scaling up adoption and deepening local value creation. This involves introducing consumer-facing incentives while simultaneously strengthening requirements for localization to prevent the strategy from simply subsidizing imports. Key policy actions should include:

1. Targeted Consumer Incentives: Introducing a system of subsidies, tax credits, or rebates for the purchase of electric vehicles (including passenger cars), but making these incentives contingent on the vehicles being assembled in Nigeria. The value of the incentive could be tiered based on the percentage of local content.
2. Investment Promotion: Actively attracting foreign direct investment (FDI) for the establishment of large-scale vehicle assembly plants and, crucially, battery repurposing and remanufacturing facilities.
3. Standardization: Developing and mandating national standards for charging plugs, communication protocols, and battery specifications to ensure interoperability and prevent market fragmentation.
4. Public Infrastructure Investment: Co-financing the development of public charging infrastructure in key urban corridors and transport hubs.

By this stage, the pro-EV coalition of local businesses and stakeholders created in Phase I can provide the political support needed to push for these more ambitious policies.

Phase III (2033 onwards): Mainstream Transition

The final phase aims to mainstream e-mobility and manage the long-term phase-out of ICE vehicles. This requires sending an unambiguous, long-term signal to the market to



guide investment and consumer behavior decisively. Key policy actions should include:

1. ICE Vehicle Importation Ban: Setting a clear, legally binding, and distant target date (e.g., 2040) for the complete cessation of the importation of all used ICE vehicles. This is arguably the single most powerful policy lever to accelerate the transition, as it forces the entire automotive market to reorient towards new technologies. A long lead time is essential to allow the market to adjust and to avoid the pitfalls of unmanaged or abrupt technological transitions.
2. Smart Grid Integration: Implementing policies and regulations to promote V2G technology, allowing EV owners to sell energy back to the grid and providing a new revenue stream that further improves the economic case for EV ownership.
3. Research and Development: Establishing public-private partnerships to fund research and development in next-generation battery technologies, local sourcing of battery materials, and advanced recycling processes.
4. Workforce Transition: Creating programs for retraining and upskilling mechanics and technicians from the ICE vehicle sector to service and repair electric vehicles, ensuring a just transition for the existing workforce.

This phased policy framework provides a predictable and logical progression that allows the market to mature, local capacity to develop, and political will to be cultivated, guiding Nigeria from its current state of paralysis to a position of leadership in African e-mobility.

CONCLUSION: BEYOND THE PARADOX

Recapitulation of the Argument: Political Will as the Primary Determinant

Nigeria's journey towards electric mobility is defined by a series of profound paradoxes: a petro-state contemplating an electric

future; a nation with an unstable grid but boundless solar potential; and a market with immense latent demand held captive by systemic inertia. This paper has systematically deconstructed the tripartite gridlock of socio-economic, infrastructural, and governance barriers that perpetuate this state of paralysis. However, it has also demonstrated that a viable, pragmatic, and evidence-based pathway forward exists.

An examination of the continental e-mobility research landscape confirms that Nigeria's most effective strategies are not speculative. Instead, they are in direct alignment with Africa's leading research frontiers, which emphasize prioritizing paratransit, leveraging decentralized solar power, and building a circular battery economy. The solutions being pioneered by continental peers, like solar charging and battery swapping for paratransit vehicles, furnish a clear and tested blueprint for Nigeria to adopt (Abraham et al., 2021; Giliomee & Booysen, 2023b).

Ultimately, the prevailing challenges are not fundamentally technological or financial. The technology exists, and viable business models are emerging. The core obstacle is a deficit of political will and policy imagination. The primary determinant of Nigeria's success in this transition will be the capacity of its leaders to enact a decisive, coherent, and long-term policy framework that can overcome incumbent inertia and unlock the nation's vast potential.

Implications for Policy and Industry Stakeholders

The findings of this paper offer clear, actionable implications for key stakeholders:

1. For the Nigerian Government: The time for deliberation is over. The immediate priority must be the development and implementation of a comprehensive National Electric Vehicle Policy, as outlined in the phased framework. This policy must provide the certainty and incentives needed to attract investment, starting with a clear focus on the

- commercial two and three-wheeler segments.
2. For Investors and Entrepreneurs: The greatest immediate opportunities lie not in the luxury passenger EV market, but in the underserved niches of commercial paratransit, decentralized solar charging infrastructure, and the nascent battery value chain. First-movers in these areas stand to capture significant market share.
 3. For International Development Partners: Support should be directed towards capacity building for policy development, financing for pilot projects in the paratransit and solar charging sectors, and technical assistance for establishing battery standards and circular economy infrastructure.

Avenues for Future Research

This paper has highlighted Nigeria's significant research deficit in the field of e-mobility. To close this gap and support evidence-based policymaking, future research should urgently address several key areas. There is a critical need for Nigeria-specific studies on consumer preferences and willingness-to-pay for electric vehicles, particularly within the commercial transport sector. Detailed TCO models for electric *okadas* and *keke napeps* under local operating conditions are required to make the business case to transport operators and financiers.

Furthermore, technical assessments of second-life battery performance in Nigeria's unique climatic conditions are essential for developing a robust and reliable repurposing industry. By investing in this domestic research capacity, Nigeria can move from being a peripheral node to a central player in shaping the future of sustainable transportation in Africa. The choice facing the nation is not merely about the types of vehicles on its roads; it is a fundamental choice about its future development trajectory, one that remains tethered to a volatile, carbon-intensive past, or one that leapfrogs into a diversified, sustainable, and electrically powered future.

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