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Nigeria E-mobility Market Report Update 2023

Curated by Clean Technology Hub

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This report was produced by Clean Technology Hub, and the following authors led the production of the report:

Byencit Duncan
Mahlon Marvin
Desmond Dogara
Abel B.S. Gaiya

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ABBREVIATIONS

AC	Alternating Current
ADC	Africa Development Capital
BEV	Battery Electric Vehicle
DC	Direct Current
EV	Electric Vehicle
EMDE	Emerging Markets and Developing Economy
E-Mobility	Electric Mobility
EMVC	Electric Mobility Vehicle Company
ESM	Environmental Sound Management
ETP	Energy Transition Plan
GDP	Gross Domestic Product
GWh	Gigawatt hour
ICE	Internal Combustion Engine
IEA	International Energy Agency
IEC	International Electrotechnical Commission
IPCC	Intergovernmental Panel on Climate Change
KMC	Kiira Motor Corporation
kWh	Kilowatt hour
MoU	Memorandum of Understanding
NA 2050	National Agenda 2050
NADDC	National Automotive Design and Development Company
NAIDP	National Automotive Industry Development Plan
NASENI	National Agency for Science and Engineering Infrastructure
OCEL	Oando Clean Energy Limited
R&D	Research & Development

SHS	Solar Home System
UNEP	United Nations Environmental Program

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Executive Summary

The Nigerian e-mobility sector has steadily grown over the past five years. Estimates of the number of EVs in Nigeria range from 300 to over 500 vehicles, with projections for electric two wheelers (the dominant EV type in Nigeria) to reach 100 to 300 thousand units by 2030. While the number of EVs on the road is likely underestimated, it is much less than estimates for South Africa, Tanzania and possibly Ghana. As the biggest importer of used internal combustion engine (ICE) vehicles in Africa, and previously having one of the largest fuel subsidy regimes on the continent and therefore one of the lowest fuel prices, the advance of the Nigerian e-mobility market has not been spectacular.

However, the number of EV companies grew between 2022 and 2023, with some geographical diversification beyond Lagos—although Lagos remains the major hub for e-mobility—. New EV production facilities have been built in Lagos and Abuja. New companies, including Nigeria's largest indigenous ICE vehicle manufacturer, have also announced plans to invest in EV production.

Major developments in 2023 have improved the attraction of the sector. These include the Federal Government's removal of fuel subsidies, which caused fuel and transportation prices to skyrocket, thereby improving the competitiveness of EVs. Progress was also made in the policy sphere, where, subsequent to the 2022 Energy Transition Plan, the Federal Government launched the National Automotive Industrial Development Plan (NAIDP), 2023-2033. The NAIDP sets a target for 40% of EVs to be locally produced in Nigeria and makes provision for several policy incentives to achieve this.

Finance still continues to be a major constraint, both for EV producers and consumers. The upfront costs of EVs remain high relative to the national median income, and no major funding facility has been established for vehicle financing or supply-side financing. Moreover, public charging infrastructure remains grossly limited. Additionally, although high-level policies and targets exist, there is still a lack of a regulatory framework for EVs and charging stations, which especially discourages private investment in public charging infrastructure due to uncertainties in the interoperability of plug types.

Given the progress made so far, the policy initiatives established, and the gaps observed in the industry, several recommendations are made to facilitate the further growth of the Nigerian e-mobility industry:

1.  **Financing:**

   Donors, investors, and federal and state governments need to establish financing facilities for EV and charging station producers and consumers. It is imperative that it stands at a pivotal juncture where it can strategically leverage the carbon market as a potent tool for generating crucial financial resources for the sector's expansion. The establishment of the Automotive Development Fund, as envisaged by the National Automotive Industry Development Plan (NAIDP) must be accelerated, and donors in the EV and mini-grid productive use of energy (PUE) space are encouraged to contribute to the fund. Policymakers and the e-mobility private sector should also identify pathways for inclusion of e-mobility in Nigeria's carbon market development plans.

2.  **Policy:**

   The National Automotive Design and Development Council (NADDC) needs to fast track the launch of an action plan that operationalizes the NAIDP and a regulatory framework that reduces regulatory gaps and uncertainty especially for charging station plug types. At the highest levels, inconsistent signalling as to whether the de jure and de facto priority is e-mobility or Compressed Natural Gas (CNG), or whether priority differs by vehicle type (such as e-mobility for two and three wheelers and CNG for buses and cars) should be avoided.

3.  **Ministerial Direction:**

   Presently, the policies on electric vehicles in Nigeria are bureaucratically dispersed. While the National Agenda 2050 under Federal Ministry of Finance, Budget and Planning and the Energy Transition Plan under the Energy Transition Office (previously under the Office of the Vice President and now required to be under the National Council on Climate Change) set the high-level targets, the NAIDP under the NADDC (in turn under the Federal Ministry of Industry, Trade

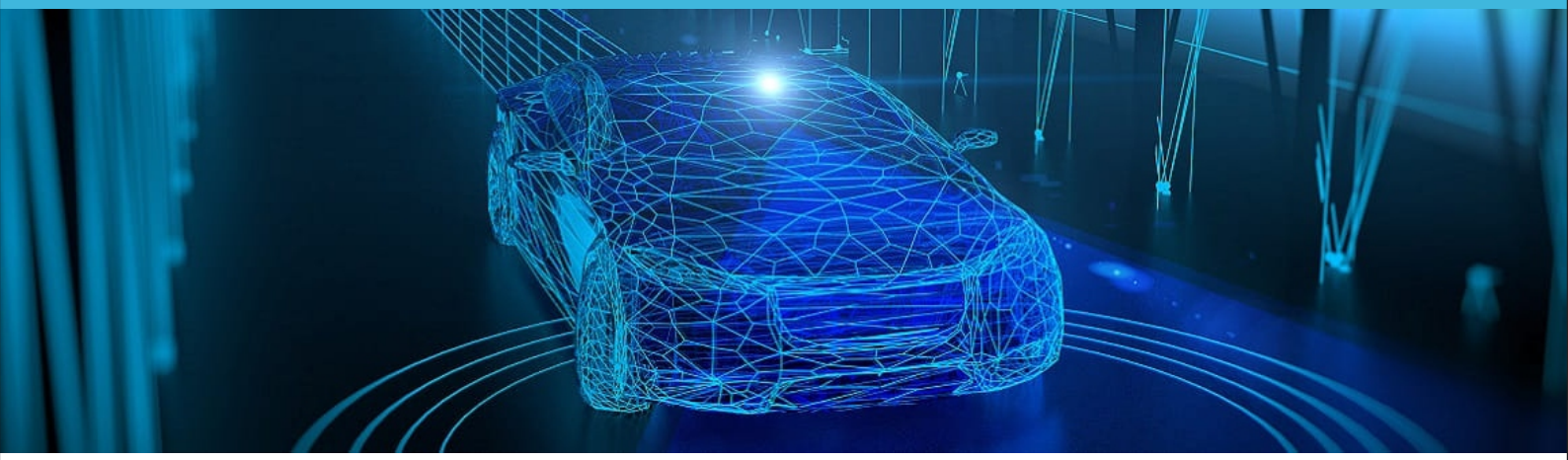
and Investment) sets the industry- and firm-level targets and implementation measures. Certain policy actors also question whether the NADDC possesses the financial and organisational capabilities to facilitate the nationwide deployment of public charging infrastructure that would be required to encourage e-mobility investment. The Federal Government should therefore consolidate e-mobility policymaking and ensure that the premier ministry of agency in the sector is provided with adequate resources and powers to achieve the goals set for the industry.

4.  Data:

Uncertainty about the size, profitability and market dynamics within the Nigerian e-mobility space continues to be an impediment to private investment. The NADDC also needs to fast track licensing requirements which include annual reporting of production and sales data in the e-mobility sector under the NAIDP.

5.  Research and Development (R&D):

R&D is an integral part of the Nigerian e-mobility sector, where the opportunity for innovation and product customisation is wider than in the solar mini-grid sector. Private companies have therefore been more active in R&D activities, but remain disconnected from academic research centres and activity. The NAIDP contains no explicit or direct provisions to encourage and incentivise R&D in the e-mobility sector and therefore the action plan being worked out by the NADDC should attempt to fill this gap.



1. Introduction

In recent years, Africa has experienced a notable surge in domestic innovations and sales of electric vehicles (EVs), marking a transformative shift in the realm of electric mobility (e-mobility) across the continent. Previously, the adoption of e-mobility was largely confined to the acquisition of costly electric four-wheelers imported from North America and Europe, primarily by high-income consumers. However, a paradigm shift is underway, manifesting in the burgeoning growth of domestic production and sales of EVs.

1.1. *Methodology*

This report is underpinned by a comprehensive array of data and insights sourced through diverse channels. A compilation of 16 stakeholder interviews served as a foundational source of firsthand information, offering valuable perspectives from key players in the industry. Additionally, a thorough analysis of secondary literature, along with careful scrutiny of relevant news reports and press releases, bolstered the report's robustness and depth of understanding. Additional data was obtained from the United Nations Environment Programme (UNEP) Global E2&3W Catalog.

Following the convention of the UNEP, this report defines electric two-wheelers and electric three-wheelers as EVs with either two or three wheels, designed for personal mobility, transport of passengers or goods, and propelled by electric motor(s) and lithium-ion batteries exclusively.[1] This excludes pedal-assist electric bicycles, electric kick scooters, and lead-acid battery based electric vehicles.

[1] UNEP (2023). *Electric Two and Three Wheelers Global Emerging Market Overview*. Nairobi: United Nations Environment Programme, p. 11.

2. Trends and Development in the EV Market

2.1. Global Trends

The global EV market has experienced significant growth in recent years and is expected to continue to grow at a rapid pace in the coming years. According to the International Energy Agency's *Global EV Outlook 2023*, in the first quarter of 2023, over 2.3 million EVs were sold, which is about 25% more than the same period in 2022.[2] The sale of EVs was expected to reach 14 million by the end of 2023, accounting for 18% of total car sales for the year.[3]

The proportion of EVs in overall car purchases surged from 9% in 2021 to 14% in 2022 and Battery EVs (BEVs) contributed to over 70% of the total annual growth, following a similar trend seen in previous years.[4] Consequently, BEVs constituted approximately 70% of the worldwide inventory of electric cars in 2022.[5]

China, Europe, and the United States make up about 95% of global sales for electric cars, with China leading the pack with 80% of sales and contributing to 60% of the global growth. Despite some growth in Emerging Markets and Developing Economies (EMDEs), electric cars remain unaffordable for the majority of the population due to the lack of accessible and affordable charging infrastructure, as well as limited access to EV servicing, maintenance, and repair. Typically, these countries rely on less expensive transportation options, such as two- and three-wheelers, which have seen greater success in electrification, alongside shared transportation for local commuting. Despite the expected increase in EV sales in EMDEs, many countries will likely continue to depend significantly on two- and three-wheelers.

Apart from the major EV markets of China, Europe, the United States, and EMDEs, India, Thailand, and Indonesia experienced a significant surge in electromobility in 2022. The sales of electric cars in these countries more than tripled compared to 2021, reaching nearly 80,000 units. Notably, sales in 2022 were seven times higher than sales in 2019 before the Covid-19 pandemic.

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[2] IEA (2023). *Global EV Outlook 2023*. Paris: International Energy Agency (IEA), p. 8.
[3] Ibid., p. 8.
[4] Ibid., p. 14.
[5] Ibid., p. 14.

In 2022, the total sales of electric two-wheelers reached approximately 9.2 million units, representing a decline of nearly 18% compared to 2021. This decrease can be largely attributed to the drop in sales of electric mopeds and motorcycles in China, which went down from 10.2 million units in 2021 to under 7.7 million units in 2022. Interestingly, despite this decline, China maintained its dominance in the global electric two-wheeler market, accounting for nearly 85% of the total sales.

On the other hand, India emerged as the leader in electric three-wheeler sales, primarily due to supportive policies and innovative business models. Electric three-wheelers play a significant role in urban mobility in India, serving both cargo and passenger transportation needs. In 2022, sales of electric three-wheelers skyrocketed to 425,000 units. India has witnessed strong sales of electric three-wheelers for several years, with hundreds of thousands of units sold annually since 2012. The only exception was in 2020, when the Covid-19 pandemic resulted in reduced sales volumes, reaching only 30% of the previous year's figures.

2.2. The African EV Market

E-mobility in Africa can be dated back to 2008 when South Africa-based Optimal Energy showcased the 'Joule', an electric four-wheeler at the Paris Auto Show. At a selling price of 300,000 South African Rand ($41,000 at the time), the Joule had a nominal driving range of 150 km and a speed of 135 km/h[6] and received the Best on Display award at the Geneva Motor Show in 2010. Optimal Energy, however, shut down after receiving R300 million in investment, and the stakeholders, including the government, believed Joule was too expensive to commercialise. [7]

In 2014, the Kiira EV was manufactured, traceable to university students at Uganda's Makerere University. This brought to life the Kiira Motor Corporation (KMC), which was officially owned by the Ugandan government and Makerere University in 2014. They are therefore responsible for the first hybrid EV designed and built in Africa and the Kayoola

[6] Barry, Keith (18 October 2000). "*South African Electric Car the Crown Joule of Paris Auto Show*", *Wired*. https://www.wired.com/2008/10/south-african-e/.
[7] Hussain, Muhammad (18 October 2019). "How South Africa Lost its Electric Joule", News 24. https://www.news24.com/citypress/business/how-south-africa-lost-its-electric-joule-20191011.

Solar Bus, which runs on lithium-ion batteries that power the electric motor plus a 2-speed pneumatic shift transmission.[8]

In recent years, the adoption of e-mobility in Africa has gained more momentum as a result of stronger global climate action since 2015 and declining costs of batteries. Mordor Intelligence data suggests that Africa's electric vehicle market was valued at $11.94 billion in 2021 and is projected to reach $21.39 billion by 2027. By 2022, there were an estimated 350 EVs in Kenya, 1,000 EVs in South Africa,[9] and 5,000 EVs in Tanzania.[10] Tanzania has the largest EV fleet in East Africa, South Africa holds the largest in Southern Africa, and Nigeria is probably the largest EV user in West Africa.[11]

Table 1: Number of vehicles and EV policy status in selected African countries

Country	Total No. of Registered Vehicles	No. of EVs	EV Policy
Tanzania	1.2 million (2016)[12]	5,000	Under development
South Africa	11.5 million (2019)[13]	1,559[14]	National Green Transport Strategy 2018-2050
Kenya	4. 3 million (2021)[15]	350	Under development

[8] Editor Wakesho (2021). "*History and Development of Electric Mobility in Africa*", *Electricbee*. https://www.electricbee.co/history-and-developments-of-electric-mobility-in-africa/.
[9] Statista (2023). "*Number of Electric Vehicles in Africa by Selected Country*",. https://www.statista.com/statistics/1285954/number-of-electric-vehicles-in-africa-by-select-country/.
[10] AfEMA (2023). *Barriers to E-Mobility in Tanzania.* Nairobi: African E-Mobility Alliance (AfEMA), p. 4.
[11] Nigeria's status as the largest EV user in West Africa is indicated by its preexisting status as holding 75% of the sub-region's registered vehicles combined with having the largest EV producer in the region (MAX.ng) and available estimates on total EV fleet size.
[12] *Ibid*.
[13] Greater Good SA (7 February 2023). "The Number of Cars on South African Roads", *MYGGSA*. https://www.myggsa.co.za/the-number-of-cars-on-south-african-roads/.
[14] Mordor Intelligence (2022). EV Market in Africa Size & Share Analysis - Growth Trends & Forecasts (2024 - 2029). Telangana, India: Mordor Intelligence.
[15] Kenya National Bureau of Statistic (2021). "*Kenya Road Transport Number of Motor Vehicles Registered*", CEIC Data. https://www.ceicdata.com/en/kenya/road-transport-number-of-motor-vehicles-registered/road-transport-no-of-motor-vehicles-registered#:~:text=Kenya%20Road%20Transport%3A%20Number%20of%20Motor%20Vehicles%3A%20Registered%20data%20was,of%203%2C954%2C839.000%20Unit%20for%202020.

Nigeria	11.8 million (2018)[16]	300-510[17]	Nigerian Automotive Industrial Development Plan 2023-2033
Ghana	2 million (2016)[18]	215[19]/17,000[20]	National Electric Vehicle Policy 2024-2045

Given the low median incomes in sub-Saharan Africa relative to North Africa and high-income countries, e-mobility in sub-Saharan Africa has been driven by the micromobility segment. Therefore, while Tanzania is estimated to hold sub-Saharan Africa's largest fleet of two- and three-wheelers, South Africa—sub-Saharan Africa's most industrialised country and Africa's highest producer and consumer of new vehicles, contributing almost 50% of the region's production and about 40% of its sales[21]—holds the largest fleet of four-wheelers. Nonetheless, these remain low when compared to the millions of motor vehicles on the road.[22] Africa as a whole and Nigeria in particular remain more inclined to use imported ICE vehicles than domestically manufactured vehicles. More than half of the 14 million light-duty vehicles (cars, SUVs, and minibuses) exported to low and middle-income countries from 2015 to 2018 were destined for Africa, with the continent also absorbing 40% of used vehicles exported globally.[23] Nigeria is Africa's largest importer of used ICE vehicles and the United Nations Environment Programme (UNEP) classifies its Used Vehicle Regulatory Regime as "Very Weak", in comparison to

[16] International Trade Administration (5 January 2023). "Nigeria - Automotive Sector". https://www.trade.gov/country-commercial-guides/nigeria-automotive-sector.
[17] AfEMA and CTH (2023). *Nigeria Fuel Subsidy Removal: Time for Electric Mobility?* Nairobi and Abuja: African E-Mobility Alliance (AfEMA) and Clean Technology Hub (CTH); AfEMA (2022). *E-Mobility Country Profile 2022: Nigeria*. Nairobi: African E-Mobility Alliance (AfEMA), p. 1.
[18] World Health Organization (2020). "Registered vehicles Data by country". https://apps.who.int/gho/data/node.main.A995.
[19] AfEMA (2022). *E-Mobility Country Profile 2022: Ghana*. Nairobi: African E-Mobility Alliance (AfEMA), p. 1.
[20] Sackitey, Daniel (11 November 2023). "Electric vehicle policy in the offing, 17,000 EVs currently in Ghana – Energy Minister", CNR CITI Newsroom. https://citinewsroom.com/2023/11/electric-vehicle-policy-in-the-offing-17000-evs-currently-in-ghana-energy-minister/.
[21] NADDC, Nigerian Automotive Industry Development Plan, p. 17.
[22] Ibid., p. 5
[23] UNEP (2020). *Used Vehicles and the Environment*. Nairobi: United Nations Environment Programme, p. 3.

South Africa, Egypt, Seychelles and Sudan which have banned the importation of used vehicles[24]

Additionally, the inaugural E-Mobility Technology Showcase in Kigali in 2021 was a great leap forward for the development of E-mobility in Africa. The showcase included Guraride, Volkswagen, Victoria Motors, Rwanda Electric Motorcycles, and Ampersand. In 2021, Ampersand, which is based in Rwanda and serves the East African market, also secured a $3.5 million investment from the Ecosystem Integrity Fund. The deal made it the largest-ever e-mobility investment by a venture capital fund in sub-Saharan Africa and it marked a turning point in global electric transport.[25]

In the area of policy adoptions and incentives for the adoption of e-mobility across Africa, progress is being made by several countries to ensure a smooth transition. Several countries, such as Kenya, South Africa, Ghana, Uganda and others, have announced their plans to develop their own EV manufacturing industries, demonstrating a growing interest in embracing e-mobility. Progress can be seen in countries like South Africa, Ghana, Rwanda, Egypt, Kenya, Cape Verde and Morocco, with other countries expected to follow suit.

The growth and development of the e-mobility sector in Africa faces challenges such as limited electricity access, vehicle affordability, and the prevalence of used internal combustion engine (ICE) vehicles. To enhance the adoption of EVs, comprehensive enabling policies are necessary. For instance, Nigeria currently lacks an e-mobility policy framework. However, plans are underway to incorporate EVs, as evidenced by the presentation of the first made-in-Nigeria EV and EV charging station by the National Automotive Design and Development Company (NADDC) in Sokoto State, Lagos State, and Enugu State.

In terms of sales, the Hyundai Kona was the best-selling electric car model in Africa in 2022, followed by the Porsche Taycan and Nissan Leaf. Electric SUVs outperformed small electric cars in terms of sales across several countries.

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[24] Ibid., p. 50.

[25] Cliffe Dekker Hofmeyr (2023). *E-Mobility in Africa: Critical for Africa's Industrialisation*. Johannesburg: Cliffe Dekker Hofmeyr Incorporated, p.5.

While e-mobility in Africa is still in its early stages, the efforts, investments, and policies being implemented indicate a positive outlook for its growth. Collaboration between governments, private sector entities, and international organisations will be crucial in accelerating the adoption of e-mobility and contributing to a more sustainable transportation landscape in Africa.

2.3. The Nigerian EV Market

There is no reliable estimate for the number of EVs currently in Nigeria. Existing estimates of 300 - 510 rely on guesstimates or a small sample of industry players' self-reported sales or stock. This may change if the National Automotive Design and Development Council (NADDC) is able to successfully implement the provision of the Nigerian Automotive Industry Development Plan 2023-2033 for vehicle assembly licensing that requires assemblers to annually report production data, employment data, and sales data across various models and exports.[26]

Nonetheless, the low estimates compared to other African regions buttresses the point that EV adoption in Nigeria is slow. Electric passenger vehicle adoption, in particular, faces a lot of hurdles, and therefore two and three-wheelers appear to be the most viable options for rapid expansion of EVs in Nigeria, especially for commercial purposes like commuting and cargo logistics. Indeed, one estimate is that by 2030, 100 to 300 thousand electric two wheelers will be sold annually.[27]

The cost of manufacturing an EV is high, and based on the income of the average Nigerian, the adoption of EVs may not see the light of day if regular passenger cars are the main focus. The sale of motorcycles is estimated to rise to 680 thousand units in 2026, amounting to a projected growth of 8.68% between 2022-2026 and a market volume of $1.29 billion.[28]

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[26] NADDC (2023). Nigerian Automotive Industry Development Plan. Abuja: National Automotive Design and Development Council, p. 37.
[27] Shell Foundation (2022). Financing the Transition to Electric Vehicles in subSaharan Africa. London: Shell Foundation, p. 14.
[28] Statistia (2023) "Transport Insight: Motorcycles in Nigeria", https://www.statista.com/outlook/mmo/motorcycles/nigeria#unit-sales.

One common practice in Nigeria is the importation of used foreign cars - the biggest importer in Africa. This is one of the many reasons why EVs are still not common. It is an invention still gaining ground in western countries, so there are not enough of them for the "fairly used" market to thrive. Moreover, the 20-year battery life of batteries is a key constraint to the emergence of a used EV global market. The average cost of a new EV is $55,600 (25.5 million naira). The current Tesla line (Model S, Model X, Model 3) ranges from N16 million to N58 million without customs duties.[29] Compared to the average annual income of 2 million naira, the production and selling price of an EV in Nigeria is too high for most people.[30]

The second major reason for the lack of take-off in the Nigerian EV space was the low price of petrol and diesel, which reduced the competitiveness of EVs for a long time. A major opportunity for the country's EV sector, therefore, came with the announcement of the removal of fuel subsidies in May 2023. Overnight, the prices of gasoline quadrupled and stimulated greater demand for alternatives to ICE vehicles and gasoline generator sets. The result was an increase in the cost of driving ICE vehicles relative to the energy cost of EVs per 100km (Figure 1).

[29] Nextier (27 November 2023). "Advancing E-mobility in Nigeria: Overcoming the Hurdles". https://thenextier.com/advancing-e-mobility-in-nigeria-overcoming-the-hurdles/.
[30] Caldeira,Ken & Dioha, Michael (14 March 2022). "Accelerating Electric Mobility in Nigeria", *Energy for Growth*. https://www.energyforgrowth.org/memo/accelerating-electric-mobility-in-nigeria/.

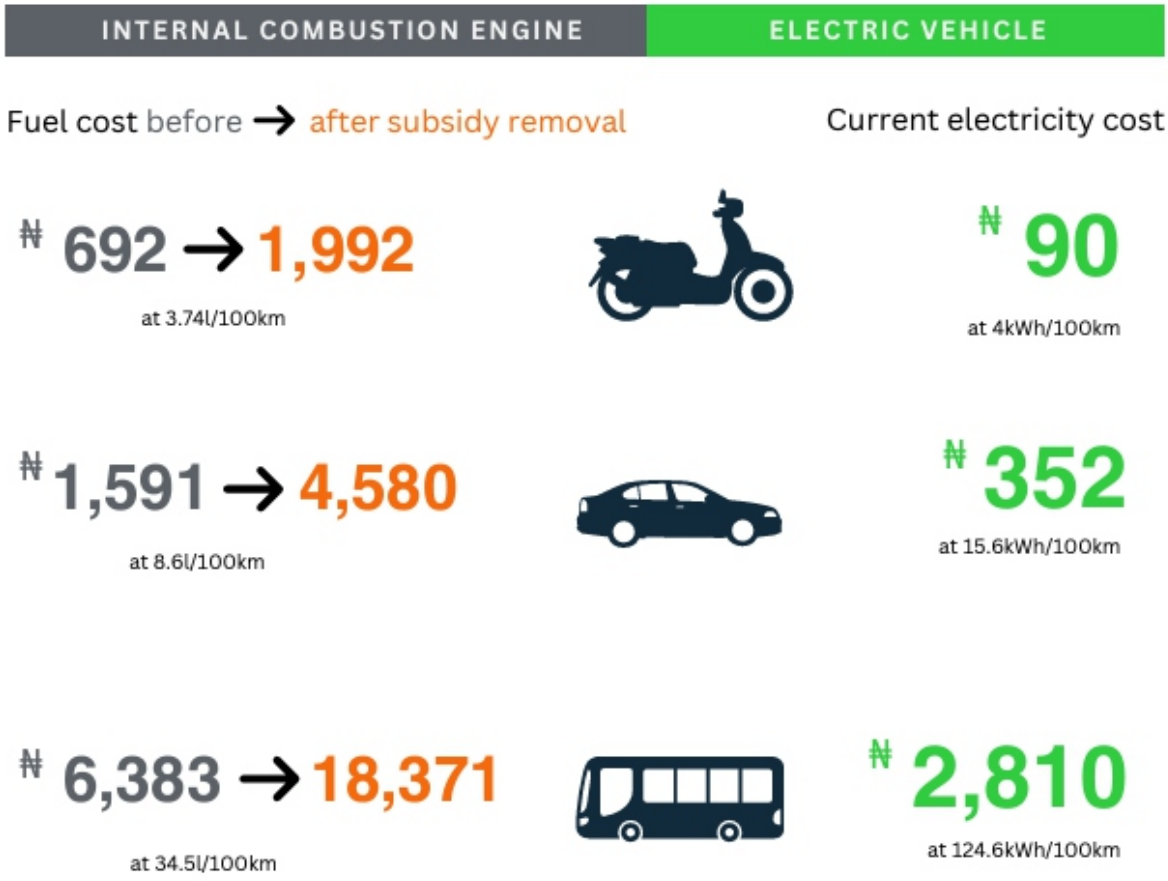

Figure 1. Energy cost implications of fuel subsidy removal for every 100 km covered.[31]

The end goal is to reduce carbon emissions from transportation and eventually obtain net zero status. The first full EV (Hyandai Kona) was launched in 2020 by Stallion Motors. The company has released a statement saying that less than 200 EVs have been sold since the launch as of September 2022, approximately 120 units[32] compared to the unit sales of passenger vehicles in Nigeria as at June 2022 totaling 15,170. There is still a huge gap the EV space has to cover to achieve a net zero emission goal target.

Box 1.0 The Energy Transition Plan and The EV Sector

The Energy Transition Plan (ETP) was launched in August 2022 by the office of the vice president of the Federal Republic of Nigeria. This plan was in accordance with the

[31] CTH & AfEMA (2023). Nigeria Fuel Subsidy Removal: Time for Electric Mobility? Abuja and Nairobi: Clean Technology Hub and African E-Mobility Alliance, p. 3.

[32] Alade, Benjamin (23 September 2022). "Two Years After Launch Less than 200 EV sold in Nigeria", The Guardian. https://guardian.ng/features/two-years-after-launch-less-than-200-electric-vehicles-sold-in-nigeria/.

Nigerian carbon neutrality commitment made by H.E. President Muhammadu Buhari commitment to carbon neutrality by 2060 at COP26. The plan focused on six major sectors, mentioning the transport section and the action plans the government had aligned to take on the adoption and eventually the full use of EVs in Nigeria by 2060. The ETP, through a document, can be regarded as the closest the Nigeria state has to a policy in the E-mobility sector.

According to the ETP, the transport sector in 2020 contributed 43 MtCO2e carbon emissions, with passenger cars accounting for 72% in-scope emissions. The execution mode for the plan is divided into two phases - pre-2030 and post - 2030. The introduction of EVs is leaned more towards the post 2030 plan with a biofuel interim substitution.

Another peculiarity of the plan is the mode-shifting method it plans to employ. The plan stated a shift mode from the use of passenger vehicles to the use of public buses and two and three-wheelers. A plan to deploy 60% of the transport sector with EVs by 2050 and eventually 100% by 2060.

Stallion Motors is not the only private sector player in the Nigerian e-mobility sector. Table 2 below lists the major EV companies operating within Nigeria. There are several other companies that have expressed intentions to become EV manufacturers in Nigeria, including the indigenous ICE vehicle manufacturer Innoson Motors, the financial firm Independent Capital, and the private-equity firm Lightrock. Several other companies have announced plans to manufacture EVs soon, including the indigenous ICE manufacturing firm Innoson Vehicle Manufacturing, the finance firm Independent Capital, and Roxettes Eco-Drives Ltd. Igbinedion University, Okada in Edo State is also building light-weight electric minibuses.

No.	Company	Year Founded	Focus	Website	Office	Planned Production	Financing Raised
1.	African Motor Works	2018	Two and Three Wheelers Electric mini-buses Charging Stations	https://africanmotorworks.com/index.html	Abuja	N/A	N/A[33]
2.	Bob Eco Nigeria Limited	2023 (entry into Nigeria)	Two Wheelers	https://www.bob.eco/	Lagos	N/A	N/A
3.	Electric Motor Vehicle Company (EMVC)	2021	Three and Four Wheelers	https://electricmotorvehiclecompany.com/	Abuja	N/A	N/A
4.	Hamster Energy Solutions	2021	Four Wheelers	https://hamsterenergysolutions.com/	Lagos	N/A	N/A
5.	Hello Bikee		Two Wheelers	https://hellobikee.com/			
6.	Jet Motors	2018	Minibuses	https://www.jetmotorcompany.com/	Lagos	N/A	$9 million
7.	Metro Africa Express (MAX)	2015	Two and Three Wheelers	https://www.max.ng/	Lagos	N/A	$31 million Series B
8.	Oando Clean Energy Limited (OCEL)		Buses				
9.	Orbit Electric Bikes	N/A	Two Wheelers	https://ebikes.ng	Lagos	N/A	N/A
10.	Osquaretec k Ltd	N/A	Two and Three Wheelers	https://osquareteckltd.wixsite.com/electric-vehicle	Ogun/Lagos	N/A	N/A
11.	Possible	2021	Four	https://possibl	Abuja	10,000	$5 million

[33] Kanife, Ejike (16 August 2023). "Meet Chukwuemeka Eze, the engineer converting 'Keke Napeps' to electric vehicles in Enugu", *Technext*. https://technext24.com/2023/08/16/chukwuemeka-eze-kekes-electric-vehicles/.

	Electric Vehicle Solution (Possible EVS)		Wheelers	eevs.com/main/		annually	
12.	Quadcycle	N/A	Four Wheelers	https://quadcyclenigeria.wordpress.com/	Nasarawa	N/A	N/A
13.	Revive Earth Ltd	2021	Retrofitting ICE Three-Wheelers and Minibuses	https://reviveth.com/	Enugu	N/A	N/A (But seeking $800,000)
14.	SAGLEV	N/A			Lagos	5,000	N/A
15.	Siltech World	2012	Two and Three Wheelers	https://siltechworld.com/	Lagos	N/A	N/A
16.	Stallion Motors	1969	Four Wheelers	https://stallion group.com/automobiles/	Lagos	N/A	N/A
17.	Thinkbikes	2020	Cargo Two Wheelers, Cargo Three Wheelers	https://thinkbikes.com.ng/	Oyo	N/A	N/A
18.	Trekk Scooters	2019	E-Scooters	https://www.trekkscooters.com/	Lagos	N/A	N/A
19.	Tswini	N/A	Three Wheelers and Charging Stations	https://tswinicompany.tech/		N/A	N/A
20.	Vocational Educational College, Abakaliki	N/A	Three Wheelers	N/A	Ebonyi	N/A	N/A
21.	Volta EV	2017	Four Wheelers	https://voltaev.co/	Lagos	N/A	N/A
Charging Station Providers							
1.	First Electric	2019	Charging Stations	https://firstelectricco.com/	Lagos	N/A	N/A
2.	Ground Zero Africa Industries	N/A	Charging Stations	https://groundzeroafrica.com/	Lagos	N/A	N/A

3	Qore	2023	Charging Stations	https://qoremobility com/	Lagos	N/A	$1.5 million
4.	Schneider Electric	2006 (entry into Nigeria)	Charging Solutions	https://www.se.com/ng/en/	Lagos	N/A	N/A

Table 2. Major EV and charging station producers in Nigeria

In the mass transit space, the biggest development has been the pilot rollout of electric Bus Rapid Transit (BRT) vehicles by Oando Clean Energy Limited (OCEL) in Lagos and Edo States in 2023. Lagos received the first set of two electric buses for the scheme while Edo will receive five buses in 2024. These are the major EV initiatives occurring among subnational governments in Nigeria.

Government Actors 1. Energy Transition Office (ETO) 2. National Automotive Design and Development Council (NDDC) 3. Rural Electrification Agency (REA) **Subnational Actors** 4. Lagos State Government 5. Edo State Government 6. Borno State Government	**Financiers** 1. GreenShift Africa 2. Sterling Bank 3. Siemens 4. Light Rock **Pending** 1. Bank of Industry 2. Jaiz Bank 3. Zenith Bank
Research Centers, Consultants and Industry Promoters 1. Clean Technology Hub (CTH) 2. Renewable Energy Association of Nigeria (REAN) 3. Rocky Mountain Institute (RMI) 4. SGS Inspection Services Nigeria Limited 5. The Nextier	**Training Centers** 1. AfricaNEV

Table 3. Other players in the Nigerian e-mobility space

3. EV Value Chain in Nigeria

The EV value chain encompasses the entire spectrum of processes involved in the production, distribution, and utilisation of EVs. It comprises a network of industries, technologies, and stakeholders collaborating to transform EV concepts into consumer products.

Furthermore, e-mobility can be categorised into three distinct value chains: the vehicle value chain, the charging value chain, and the surrounding network value chain. While the latter is not a conventional chain, it represents a separate category of policy considerations. Policy interventions can target one or more elements within these chains. For instance, a purchase subsidy would primarily impact the vehicle's value chain, specifically the consumer segment.

In Nigeria, the value chain for internal combustion engine (ICE) vehicles is well-established and forms a strong component of the fuel vehicle industry. However, the value chain of the EV market in Nigeria is yet to be developed, as the sector is budding. It is still in its nascent stages of development.

Currently, the EV value chain in Nigeria is evolving with the involvement of various stakeholders, including government entities, automobile manufacturers, charging infrastructure providers, and consumers. Efforts are being made to establish the necessary infrastructure, such as charging stations and battery recycling facilities, to support the growth of the EV market.

However, challenges remain, including the limited availability of EV models, high initial costs, and a lack of widespread charging infrastructure. These factors impact the different stages of the EV value chain, from production and distribution to utilisation and support services.

To foster the development of the EV value chain in Nigeria, there is a need for strategic policy interventions, investments, and collaborations among stakeholders. This includes initiatives to incentivize EV adoption, promote local manufacturing of EV components, and establish a comprehensive charging infrastructure network across the country.

As the EV market continues to grow globally, Nigeria has the potential to establish a sustainable and thriving EV value chain, contributing to reduced emissions, energy security, and technological advancements in the transportation sector.

3.1. Batteries

The battery power pack is a vital component of EVs, serving as the electrical storage system that powers the vehicle's electric motors. Among various types of batteries, lithium-ion (Li-ion) is widely used in EVs due to its high energy density and other favourable characteristics. Li-ion batteries consist of a positively charged cathode made up of lithium, nickel, cobalt, and manganese, a negatively charged anode primarily composed of graphite, and an electrolyte that separates them. Average battery capacity in Africa varies by the type of EV, ranging from 2.1 kWh for scooters to 6.3 kWh for cargo three-wheelers.[34]

Globally and in Nigeria, there is a growing demand for EV batteries, driven by a general shift towards carbon neutrality. By 2030, it is projected that the annual global demand for batteries will reach approximately 4,500 gigawatt-hours (GWh), representing a 30% growth. Consequently, the battery value chain is expected to expand significantly, potentially increasing by up to ten times between 2020 and 2030, with projected annual revenues reaching as high as $410 billion. Notably, the price of lithium, a key component of Li-ion batteries, has experienced a substantial increase from around $6,000 in 2020 to over $78,000 in 2022.[35]

The global production of lithium has reached a peak from 35,000 metric tonnes to 130,000 in the last decade[36] based on the estimated global demand increase due to expanded usage. Before 2015, lithium was in demand for just ceramics, greases, metallurgical powder, and polymer industries; the case has however taken a great turn with the uproar of the battery industry, emphasising its high capacity energy storage of

[34] UNEP, Electric Two and Three-Wheelers, p. 28.
[35] Andreas, Breiter, Evan, Horetsky, Linder, Martin, & Rettig, Raphael (18 October 2022). "Power spike: How battery makers can respond to surging demand from EVs", *McKinsey & Company. https://www.mckinsey.com/capabilities/operations/our-insights/power-spike-how-battery-makers-can-respond-to-surging-demand-from-evs.*
[36] Statista(2024). "Mine production of lithium worldwide from 2010 to 2022". https://www.statista.com/statistics/606684/world-production-of-lithium/.

lithium-ion batteries. The insufficient supply of lithium to match the demand level has been a major change for the sector. According to Market Balance Forecasts, the annual lithium demand is projected to reach roughly 1.5 million metric tonnes of lithium carbonate equivalent by 2025 and over 3 million metric tonnes by 2030, and the EV sector could account for about 84% of total lithium demand in 2030, up from about 55% in 2021.[37]

Although Nigeria has recently begun exploring the potential of industrial lithium exploration, several states, such as Kogi, Nassarawa, Kwara, Kaduna, Ekiti, Cross River, Oyo, and Zamfara, have reported the discovery of lithium deposits.[38] As of 2019, high-grade lithium deposits of approximately 50 metric tonnes were found in Nigeria, with oxide content ranging from 1% to 13%. Normally, exploration begins at lower levels, often as low as 0.4%. The grade, measured in percentage, indicates the concentration of lithium in the minerals or rocks that contain it. Higher-grade deposits are generally more economically viable. However, the extent of lithium mining in Nigeria remains relatively unknown, as the federal government, responsible for mineral resource exploration and discovery, has not fully prioritised these efforts.[39]

Concerns regarding the lifespan, disposal, and recycling of batteries arise in the context of mass battery production and usage. Building and transitioning to EVs aim to reduce emissions and protect the environment, making it counterproductive to improperly dispose of these batteries and contributing to the very climate change EVs seek to combat.

Compared to the lifespan of the vehicle itself, EV batteries typically have a lifespan of 15 to 20 years or can run for 100,000 to 200,000 miles, often outliving the vehicles they are installed in. This presents an opportunity for these batteries to be given a second life.[40]

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[37] Lucas, Alec (4 November 2022). "*Lithium Market Update: Elevated Prices Are Creating Favorable Dynamics for Miners*", Global X. https://www.globalxetfs.com/lithium-market-update-elevated-prices-are-creating-favorable-dynamics-for-miners..

[38] Eleanya, Frank (25 October 2021). "*Nigeria missing from electric vehicles value chain despite mineral deposits*", Business Day. https://businessday.ng/news/article/nigeria-missing-from-electric-vehicles-value-chain-despite-mineral-deposits/.

[39] Garba, Ibrahim (24 June 2022). !Nigeria's latest lithium find: some key questions answered", *The Conversation*. https://theconversation.com/nigerias-latest-lithium-find-some-key-questions-answered-185069.

[40] EV Box (5 April 2023). "Are electric car batteries recyclable?" EV Box Blog. https://blog.evbox.com/are-ev-batteries-recyclable#:~:text=To%20address%20the%20elephant%20in,in%20an%20easily%20recyclable%20way..

Battery recycling involves shredding the battery pack to separate its various elements. The resulting materials are then filtered based on size and composition, segregating plastics, ferrous metals (metals containing iron), and non-ferrous materials. Valuable materials such as lithium, cobalt, nickel, and manganese are extracted through processes like pyrometallurgy (applying high heat to burn away non-metal parts) or hydrometallurgy (exposing the mix to chemical solutions to recover the appropriate materials).

Battery recycling can recover up to 95% of key raw materials from the battery pack and reintegrate them back into the battery manufacturing supply chain. While recycling is a clean and sustainable approach, it is still an energy-intensive process.[41] Therefore, it is advisable to consider recycling as a last resort. Additionally, when battery capacity has significantly depreciated to as low as 60% to 70% of the original, the extracted materials can be repurposed for less energy-intensive devices.

In February 2022, the Nigerian government launched the National Policy on Waste Battery Management as part of the activities during the European Union Climate Diplomacy Week. This policy aims to provide specific guidelines on the Environmental Sound Management (ESM) of waste batteries, ensuring proper handling and disposal practices.

3.2. Vehicles

The EV (EV) market in Nigeria is still in its early stages, facing challenges such as high initial costs, inadequate infrastructure, and limited consumer awareness. However, significant strides have been made in Nigeria's EV market, both from the government and private sector, and several factors are expected to drive its expansion.

Most of the EVs in use in Nigeria are either imported or produced locally. However, product marketing strategies differ. For two- and three-wheelers of lower quality, a common practice is to locally fabricate and develop two and three-wheelers while batteries (which make up the largest percentage of production costs) are imported. For higher quality two- and three-wheelers or mini-buses, many manufacturers have R&D teams that design their products within Nigeria, while they make use of supply

[41] Ibid 26

agreements with foreign Original Equipment Manufacturers (OEMs) especially in China, who produce the vehicles according to specifications and transport them to Nigeria in SKD or CKD form. These are then assembled in Nigeria and sold to consumers.

Using the UNEP Global E2&3W Catalog which contains a catalogue of two and three-wheeled EV types by model name and producer, it appears that the prices of EVs in Nigeria are higher than those of other African countries. Based on 22 two and three wheelers produced by the EV producer, Siltech, the average price is N2.8 million, with the cheapest being its E-Cally Cruiser (a cruiser motorcycle) at N750,000 with the lowest top speed (65 km/h) and range (45 km) among the other options.[42] This excludes vehicles above N20 million (E-EGO and Harley Davidson). It appears that the average price of two and three wheelers in Nigeria ($6,223) is almost twice the average price in the six African countries for which prices are recorded ($3,030), while the prices for the highest-priced vehicles in Nigeria ($63,043) are far above the highest prices in the six other African countries in the Catalog ($11,421 in Zambia). This may reflect a number of conditions, including the high production costs in Nigeria and the large enclave population of high income and upper middle class people able to afford the high prices at the extreme of the vehicle price distribution.

There is evidence of some industrial and technological upgrading in the sector. Certain major EV producers have, or have planned to acquire, new machinery, such as laser cutting technologies, that enable the manufacture of certain components within Nigeria. Others are incorporating digital technologies into their products, although this appears to be limited to passenger vehicles whose target customers can afford to absorb the slightly higher prices resulting from this value addition and commercial minibuses for which such digital technologies are functional to profitability. Examples are logistics companies being enabled to better track the routes taken by drivers and therefore minimise fuel consumption and time wastage, and minibus taxi owners being able to track the number of passengers daily and therefore reduce underreporting of revenues by drivers. For two- and three-wheelers, innovations are typically limited to smaller improvements with maximum innovation potential, such as improving the carrying capacity of cargo EVs up to physical limits.

[42] Courtright, Tom, Chollacoop, Nuwong and Pardo, Carlos F. (2023). "Global Electric Two and Three Wheeler Catalogue of Asia, Africa and Latin America", Google Drive. https://bit.ly/unep-e23w-database.

The Nigerian government has announced plans to implement policies that incentivize the adoption of EVs. These measures include tax benefits, subsidies, and reduced import duties, making EVs more affordable and appealing to consumers under the National Automotive Industry Development Plan (2023-2033). Moreover, the rising costs and volatility of fuel prices due to subsidy removal make EVs increasingly attractive as an alternative option. Additionally, EVs are seen as cleaner alternatives to gasoline-powered cars, capable of reducing greenhouse gas emissions and improving air quality. Increasing awareness among the population about environmental degradation and the benefits of EVs is expected to accelerate their adoption in Nigeria in the coming years.

Advancements in battery technology are also contributing to the affordability of EVs, providing longer driving ranges and shorter charging times. These developments make EVs more competitive with conventional cars in terms of price and convenience.

Furthermore, the Federal Government of Nigeria has entered into agreements with companies from Israel, Japan, and Nigeria to commence the assembly and manufacturing of environmentally friendly, green, electric, and smart automobiles by 2023. The Memorandum of Understanding (MoU) was signed by the National Agency for Science and Engineering Infrastructure (NASENI) and firms from Israel and Japan to support this initiative.[43]

The release of the ETP has spurred tangible efforts from various private and international stakeholders to foster the expansion of the e-mobility sector in Nigeria. The market has witnessed significant growth and generated considerable interest, with foreign players expressing their intent to explore opportunities within the Nigerian e-mobility market.

Between 2022 and 2023, the new E-mobility companies that have surfaced include Oando Clean Energy Limited (OCEL), Electric Mobility Vehicle Company (EMVC), Quadcycle, Volta EV and Trekk Scooters.

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[43] Usigbe, Leon(26 August 2022). "Nigeria to begin manufacturing, assembling electric cars by 2023", *Tribune*. https://tribuneonlineng.com/nigeria-to-begin-manufacturing-assembling-electric-cars-by-2023/#google_vignette.

3.3. Charging Stations

As the adoption of EVs increases in Nigeria, the establishment of charging stations is crucial to supporting the growing EV ecosystem. These stations can be built in various places, such as residential areas, commercial centres, parking lots, or along major highways.

Charging stations in Nigeria play a vital role in enabling EV owners to conveniently recharge their vehicles, extending their driving range, and promoting sustainable transportation. The development of a robust charging infrastructure is essential to address range anxiety, encourage EV adoption, and facilitate the transition towards a greener transportation system in Nigeria.

In Nigeria, the e-mobility infrastructure is gradually developing, with a limited number of public charging stations currently available. As of now, there are five public charging stations in the country. The National Automotive Design and Development Council (NADDC) has developed four of these stations (University of Lagos, Usman Danfodio University in Sokoto, University of Nigeria in Nsukka and the NADDC Head Office in Abuja), demonstrating the government's commitment to promoting EV (EV) adoption. Additionally, Sterling Bank Nigeria has recently launched one public charging station in Lagos State.

Apart from these public charging stations, there is also a growing presence of private charging infrastructure. Private organisations, particularly those involved in assembling EVs, have taken the initiative to install privately-owned commercial charging stations as part of their business model. This practice of installing private charging stations is becoming more prevalent, with several EV companies engaging in this approach to facilitate charging for their customers. There are also private organisations that focus mainly on building charging stations based on demand. Notable examples of companies include First Electric and Hamster Energy, which have taken the lead in establishing private charging stations. High income and upper middle income consumers with electric cars often have private charging stations installed at their homes.

As a recent United Nations Environment Programme report maintains, in most settings, dedicated charging infrastructure for two- and three-wheeled EVs remains rudimentary.[44] Home-charging is most commonly undertaken with simple wall chargers and charged at around 500 W to 1 kW using the chargers provided with the vehicle at sale.[45]

A few government establishments have also installed or have expressed interest in installing charging stations at their branches for their staff, driven by demand from high level bureaucratic elites who own their own electric cars but have no close access to charging stations outside of their homes. The commonality among these institutions is that they are either top revenue-generating and quasi-independent agencies or at the forefront of the energy transition and climate action.

Although the number of public and private charging stations in Nigeria is still relatively limited, the presence of both government-developed and privately-installed charging infrastructure indicates a positive trend towards the growth and accessibility of e-mobility options in the country. It is expected that, with increased investment and support, the charging infrastructure network will expand, facilitating the wider adoption of EVs in Nigeria. The Energy Transition Plan envisions the possibility that post-2030 charging infrastructure will grow by 3,000 charging stations annually, from 60 stations in 2030.[46]

The absence of public charging stations, as well as the long battery charging times (two to five hours), have meant that battery swapping stations have become more popular. Paying per state-of-charge (SOC) pricing strategy has also been more popular than, per km, subscription, and flat rate per swap pricing strategies.[47]

As the charging infrastructure for EVs (EVs) continues to expand, it becomes increasingly important to address the issue of standardisation. Currently, there are various types of charging plugs used for both Alternating Current (AC) and Direct Current (DC) chargers, creating a lack of uniformity in the charging infrastructure. Indeed, the fifteen socket and plug types globally have limited interoperability.[48]

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[44] UNEP, Electric Two and Three Wheelers, p. 30.
[45] Ibid., p. 30.
[46] Energy Transition Plan (2022). "Transport". https://www.energytransition.gov.ng/transport-2-2/.
[47] UNEP, Electric Two and Three Wheelers, p. 33.
[48] Ibid., p. 30.

Standardisation of charging stations is crucial to ensuring compatibility and convenience for EV owners. By establishing common charging standards, such as standardised plug types and communication protocols, EV users would have a seamless experience when charging their vehicles across different charging stations.

Implementing standardised charging infrastructure would enable EV owners to easily access charging facilities, regardless of the charging network or location. It would also promote interoperability, allowing EVs from different manufacturers to charge at any compatible charging station without compatibility issues.

Moreover, standardisation would encourage competition and innovation in the charging industry. With a common framework in place, charging station manufacturers can focus on improving the efficiency, safety, and accessibility of their products, driving the overall advancement of the EV charging infrastructure.

To achieve standardisation, collaboration among stakeholders is essential. Governments, automotive manufacturers, charging station manufacturers, and other industry players should work together to establish and adopt widely accepted charging standards. International organisations, such as the International Electrotechnical Commission (IEC) and regional bodies, can also play a crucial role in developing and promoting standardised charging solutions.

By prioritising the standardisation of charging stations, the EV industry can provide a more user-friendly and reliable charging experience, thereby encouraging wider EV adoption and contributing to the growth of sustainable transportation. Below is a picture of the various types of charging plugs and their regions.

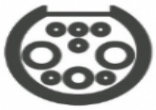
Current type and plug name	Region			
	Japon	China	America	Europe
AC				
Plug name	Type 1 - J1772	GB/T	Type 1 - J1772	Type 2
DC				
Plug name	CHAdeMO	GB/T	CCS - Type 1	CCS - Type 2

Figure 2. Types of Charging Plugs for EVs[49]

Box 2.0

Installing a Charging Station in Nigeria

The cost of installing a charging station in Nigeria can vary based on several factors, such as the type of charging station, location, and infrastructure requirements. However, it is important to note that the cost landscape will continue to change due to evolving market conditions, government policies, and technological advancements.

A significant proportion, 90% of the charging station components, are imported, making importation costs to range from 90% to 95% of the overall production cost. About 20% of the cost of importing is the transportation cost, while 10% is made up of .

On average, the cost of installing a normal mobile charging station, depending on the voltage and current, falls within the range of 300,000 to 700,000 naira, taking around 4 hours for an AC-installed charger. For a DC charger, the cost significantly escalates to

[49] EV Expert (2022). "Connector types for EV charging around the world". https://www.evexpert.eu/eshop1/knowledge-center/connector-types-for-ev-charging-around-the-world.

over 3 million naira. This high installation cost is a direct consequence of the expensive imported components and associated importation duties.

Importantly, these charging stations offer flexibility in their connection, allowing direct connection to the grid or functioning off-grid using Solar Home Systems (SHS) or micro-grids. This adaptability provides alternatives for powering the charging stations, which is crucial in the context of Nigeria's varied energy landscape.

4. Funding Gaps and Market drivers

4.1. Funding Gaps

There is a global need for increased funding for decarbonisation, which cuts across various sectors. Relative to more established technologies like Stand Alone Solar (SHS) and mini-grids, this funding gap is even more marked for emerging technologies such as E-Mobility. The Intergovernmental Panel on Climate Change (IPCC) estimates $1.6 trillion to $3.8 trillion to be used annually to avoid global warming exceeding 1.5°C in contrast to existing spending amounting to $632 billion per year in 2019-2020, out of which $175 billion is spent on transportation.[50] The funding gap for developing countries is even greater, given that high-income countries have not kept their promise of $100 billion contributions for climate financing to developing countries by the year 2020.[51]

Yet, the funding gap for E-Mobility is very wide for both infrastructure development and research and development. For example, the electric mobility infrastructure global investment funding gap is currently $45.25 billion for 2021 to 2023. This gap is set to widen to $104.11 billion from 2024 to 2026 if investments do not increase.[52] According to the World Bank, the annual financing gap for transport infrastructure is estimated at USD 944 billion per year, projected up to the year 2030. This substantial amount surpasses the availability of funding from traditional sources.[53] The Nigerian Energy Transition Plan

[50] Timperley, Jocelyn (20 October 2021). : "The broken $100-billion promise of climate finance — and how to fix it",. *Nature*. https://www.nature.com/articles/d41586-021-02846-3.
[51] Ibid.
[52] Siemens (2024).. "Financing Decarbonisation: E-Mobility". http://siemens.com/financing-decarbonization.
[53] Minovi, Shokraneh (3 March 2022). "Shaping The Future of Transport and Climate Action with Four Words". *World Bank Blogs*.

estimates that Nigeria needs $21 billion in incremental capital investments from 2021 to 2060 to achieve its net zero vision (100% EV in the passenger vehicle mix by 2060) in the transportation sector by 2060.[54] According to the African E-Mobility Alliance (AfEMA), e-mobility companies in Nigeria raised over $10 million, with 13 e-mobility companies contributing to this achievement. This is second only to Kenya ($52 million by 40 companies) among the seven countries assessed.

In Africa, R&D deficiencies and funding gaps limit the scaling up of EV development and sales.[55] The challenge differs by firm type, EV technology, and country environment. For instance, in an oil-producing country like Nigeria, automobile importers and assemblers benefit from the petrol subsidy regime, which keeps fuel prices low and therefore serves as a disincentive to EV adoption. In contrast, in East Africa, there is greater government attention paid to e-mobility, such as in Uganda and Kenya.

The United Nations Environment Programme (UNEP) has been actively involved in promoting e-mobility in Africa. The organisation has been working in nine countries to introduce electric two and three-wheelers, including Ethiopia, Togo, Kenya, Rwanda, Uganda, Burundi, Madagascar, Sierra Leone, and Tanzania. They are also working with the Global Fuel Economy Initiative on baseline setting and policy development for the introduction and shift to EVs in the following African countries: Ghana, Mauritius, Mozambique, Tunisia, Côte d'Ivoire, and Zambia. UNEP is also engaged in the development of electric buses through the Global Electric Mobility Programme and the Soot-free Urban Bus Fleet project of the Climate and Clean Air Coalition in countries like Cote d'Ivoire, Senegal, Seychelles, South Africa and Tanzania.[56]

In 2020, Nigerian automobile company Jet Motor Company successfully secured $9 million in funding from foreign investors to accelerate the development and production of EVs (EVs) and propel market expansion. The funding was obtained from Canada-based Africa Development Capital (ADC), Great Man Legend, and other Asian investors. The

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https://blogs.worldbank.org/transport/shaping-future-transport-and-climate-action-four-words#:~:text=Avoid%2C%20shift%2C%20improve%2C%20strengthen,for%20mobility%20and%20climate%20action..

[54] Energy Transition Plan (2020). "Finance". https://www.energytransition.gov.ng/#Finance.

[55] Siemens (2020). *E-Mobility Solutions for Rural Sub-Saharan Africa: Leveraging Economic, Social and Environmental Change*. Munich: Siemens.

[56] *UNEP (2024)*. "Africa Sustainable Transport Forum". https://www.unep.org/explore-topics/transport/what-we-do/africa-sustainable-transport-forum.

company will use the investment to support the research and development of its EVs, known as JET EV.

The Nigerian Automotive Industrial Development Plan (NAIDP) 2023-2033 intends to revive the Nigerian Automotive Development Fund, to be funded by 15% of the import levy on New and Used Vehicles.[57] This is in order to provide supply-side financing at single-digit interest rates to automotive manufacturers including EV manufacturers, up to a maximum of N1 billion per Vehicle manufacturer, N500 million per Auto Components manufacturer and 5 years maximum loan tenor. A N950 billion demand-side loan facility is also envisioned to provide up to N10 million per passenger vehicle for an estimated 45,000 units a year and up to N10 million per commercial vehicle for an estimated 50,000 units a year at single digit interest rates, a 5-year loan term, and a down payment of 10 - 20% of the vehicle cost.

4.2. Market Drivers

The e-mobility sector in Nigeria has experienced remarkable growth over the past year, marking a significant shift towards sustainable transportation. Several key factors have contributed to this surge, and these drivers remain instrumental in propelling the continuous expansion of the sector. The e-mobility sector in Nigeria owes much of its success to the proactive efforts of the private sector, which played a pivotal role in driving the widespread adoption of this technology. Their active involvement and investments have been instrumental in pushing forward the e-mobility agenda in the country, making EVs and cleaner transport options more accessible to the public.

Additionally, the Nigerian government, under the leadership of the former vice president, took a significant step towards promoting cleaner transport by releasing the ETP. The plan laid out a well-structured transition plan towards e-mobility and served as a guiding framework for the sector's development.

The National Automotive Design and Development Council (NADDC) organised a workshop to validate the EV (EV) Roadmap. This strategic roadmap provides a clear path for the integration of EVs into Nigeria's transportation system. As it awaits its official

[57] NADDC, Nigerian Automotive Industry Development Plan, p. 50.

enactment into law, this roadmap is expected to further solidify the foundation for e-mobility and pave the way for more sustainable transportation options.

The combined efforts of the private sector and the government, as reflected in the ETP and the signing of the EV Roadmap, are crucial in steering the e-mobility sector towards Success in Nigeria. This collaborative approach has not only accelerated the adoption of EVs but also laid the groundwork for a cleaner and more sustainable future in the country's transportation sector. With continued dedication and support from both sectors, e-mobility is poised to continue its upward trajectory in Nigeria.

5. Policy Roadmap for Adoption of EV (EV) in Nigeria

The burgeoning EV (EV) ecosystem in Nigeria is gradually making its way into the automotive market. The active involvement of the private industry has piqued the interest of various government agencies, notably evident in the inclusion of EVs in the energy transition plan.

However, there is some inconsistency in government targets and plans for e-mobility in Nigeria. The Nigeria Agenda 2050 (NA 2050), which is "the long-term economic transformation blueprint of Nigeria" was launched in 2021 under the Federal Ministry of Finance, Budget and National Planning.[58] Some of its objectives and Key Performance Indicators of the electricity sector include reaching a percentage of EVs in the national vehicle mix of 7.5% by 2025, 14% by 2030, 20.5% by 2035, 27% by 2040, 33.5% by 2045 and 40% by 2050 as well as a percentage of cities with EV charging stations at 17.5% by 2025, 34% by 2030, 50.5% by 2035, 67% by 2040, 83.5% by 2045, and 100% by 2050 (see Table 2).[59]

Key Performance Indicators	Baseline	Target (%)					
	2020	2025	2030	2035	2040	2045	2050
Percentage of cities with electric power charging stations/	<1	17.5	34.0	50.5	67.0	83.5	100

[58] Federal Ministry of Finance, Budget and National Planning (2021). Nigeria Agenda 2050. Abuja: Federal Ministry of Finance, Budget and National Planning, p. 95, 184
[59] Ibid., p. 95.

outlets (percent)							
Percentage of electric vehicles in total	<1	7.5	14	20.5	27.0	33.5	40
Percentage of vehicles powered by compressed natural gas (CNG)	<1	5.83	10.67	15.50	20.33	25.17	30

Table 4. Objectives and Key Performance Indicators of the Electricity Sector and for Environmental Management for the e-mobility sub-sector.[60]

The NA 2050, however, does not mention how these will be achieved beyond "promote the use of zero emission vehicles such as electric cars, through appropriate incentives and sanctions frameworks" and "encourage the deployment of electric vehicles (EVs), including investments in energy storage devices and systems".[61] The NA 2050, nonetheless, notes that more specific strategies, programmes, interventions, and the important task of implementation will be articulated through six five-year medium-term plans.[62] Yet, the first volume of the NDP (2021-2025) makes no single mention of electric vehicles.[63]

Subsequent to this, the Net Zero Vision of the Nigeria Energy Transition Plan 2022 foresees electric vehicles making up only 1% of the passenger vehicle mix by 2030. It considers passenger EVs and charging infrastructure to be only realistic post-2030 (at a Cumulative Annual Growth Rate of 1.5% annually) while, in the interim, biofuels can help decarbonize the sector (with a 10% blend rate by 2030). Therefore, EVs are envisioned to make up 60% of the passenger vehicle mix by 2050 and 100% by 2060 (Figure 2).

[60] Ibid., p. 95.
[61] Ibid., 96, 185.
[62] Ibid., 3.
[63] Federal Ministry of Finance, Budget and National Planning (2021). National Development Plan (NDP) 2021-2025, Volume I. Abuja: Federal Ministry of Finance, Budget and National Planning.

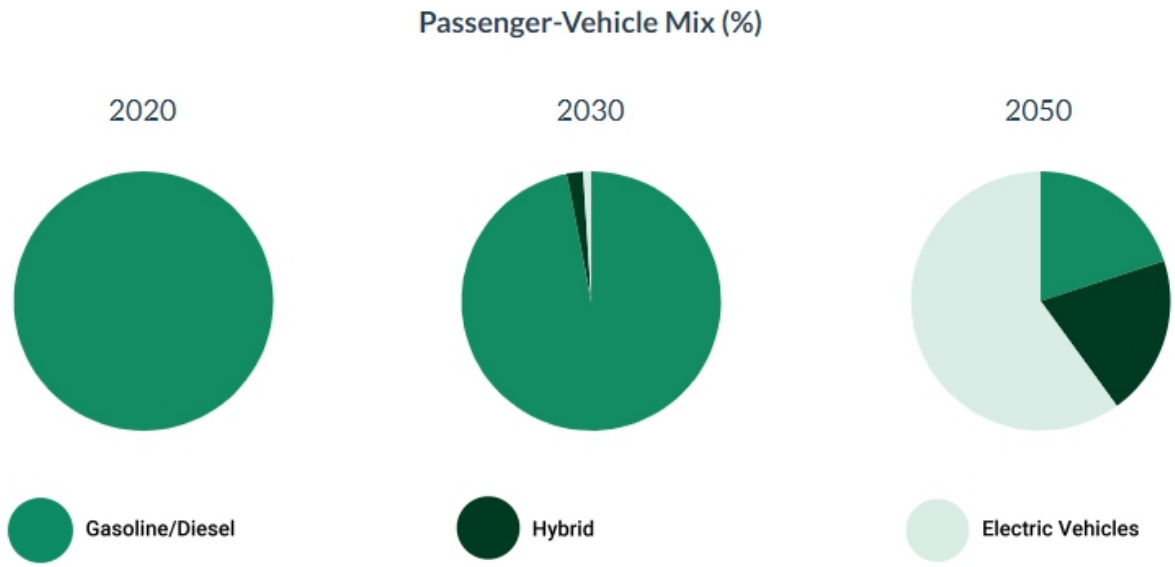

Figure 3. Passenger-vehicle mix under the Nigeria Energy Transition Plan Net Zero Vision.[64]

The NA 2050 set a goal of 14% of electric vehicles in the total vehicle mix by 2030 and the ETP sets the broader goal of 1% of the passenger vehicle mix by 2030 (although no goal exists for two- and three-wheelers)—an inconsistency that can only arise if there was no coordination with the NA 2050 in setting the ETP targets or if the NA 2050 implies that two- and three-wheelers will make up the vast majority of EVs by 2030. Although the NA 2050 target is close to McKinsey's estimate of electric two-wheelers reaching 5-15% of total two-wheeled vehicles by 2030,[65] the absence of Compressed Natural Gas (CNG) vehicle targets in the ETP and NAIDP suggest that non-coordination on this matter among the government ministries that developed the plans—the Federal Ministry of Finance, Budget and Planning for the NA 2050, the National Automotive Design and Development Council under the Federal Ministry of Industry, Trade and Investment Energy for the NAIDP, and the Energy Transition Office (previously under the Office of the Vice President and now required to be under the National Council on Climate Change) for the ETP—accounts for these policy inconsistencies.

While both the NA 2050 and the ETP set high-level goals, the 2023 National Automotive Industry Development Plan (NAIDP) from 2023 to 2033 sets goals related to local content

[64] Energy Transition Plan (2020). "Transport". https://www.energytransition.gov.ng/transport-2-2/.
[65] Shell Foundation, *Financing the Transition to Electric Vehicles in subSaharan Africa*, p. 15.

and local production and is more specific in the policy tools to achieve this. The NAIDP aims to increase local production of vehicles and achieve 40% local content in line with the requirement for vehicles to have "at least 40% regional content" in terms of its production components to be eligible for duty-free export within the African Continental Free Trade Agreement (AfCFTA) region.[66] The plan also envisions 30% locally produced two-, three- and four-wheeled EVs by 2033, therefore indicating a prominent role for foreign-produced EVs for the foreseeable future.

	Area	Description	Targets
	Production	Number of passenger and commercial vehices to be manufactured in-country	**200,000**
	Regional Market Share	Proportion of thr regional automotive indurty share	**26%**
	Mode of Manufacturing	Manufacturing type i.e. CKD and CBU	**CKD Manufacturing**
	Local Content	Amount of local content utilised in manufacturing	**40%**
	Electric Vehicles	Ration of electric vehicles to combustion engine vehicles produced in country	**30% of local production**
	Employment	Number of people employed directly and indirectly by the automotive industry	• **33,000 - 54,000 Direct** • **600,00 - 1,000,000 Indirect**

Figure 4. Targets set for the NAIDP 2023.[67]

To achieve this, the NAIDP proposes a differential tariff structure as an incentive for the sector, with eligibility for this incentive determined by the NADDC (Figure 5).

[66] NADDC, Nigerian Automotive Industry Development Plan, pp. 29-30.
[67] Ibid., p. 31.

Tariffs						
	0 - 5 Years			6 - 10 Years		
	Import Duty	VAT	Import Levy	Import Duty	VAT	Im-port Levy
SKD EVs	0	PR	0	10	PR	0
Used EVs	20	PR	15	20	PR	15
New EVs	20	PR	0	20	PR	15
New FBU - Concessionary Imports*	10	PR	0	20	PR	0

* Provided that where the import volume of electric vehicles into Nigeria reaches 40,000 units per annum, the rates of import duty and import levy on used electric vehicles shall be 20% and 80% respectively.

* Import volumes shall be subject to the volumes reached in previous year. The concession will not be applicable on models being manufactured in-country

* *PR: Prevailing Rate*

Figure 5. Tariff structure for auto-components and kits proposed under the NAIDP 2023 for SKD, Used, New and New Fully-Built units (FBU).[68]

The NAIDP includes other incentives such as:

- Value-based non-transferable import levy rebates for CKD manufacturers who have supply agreements with, and patronize, local component manufacturers;
- Ten years tax holiday for assemblers who invest in CKD mode of manufacturing for Tricycle and Motorcycle assemblers or in SKD/CKD mode of manufacturing for vehicles;
- Accelerated capital allowances for plant and machinery purchased by EV manufacturers and auto-suppliers from 5 years to 1 year who invest in CKD mode of manufacturing for Tricycle and Motorcycle assemblers or in SKD/CKD mode of manufacturing for vehicles;
- Asset finance scheme whereby capital funds at single digits interest rates for Made-in-Nigeria automotive manufacturers and auto-component manufacturers are provided;
- Three-year tax holiday for cab and courier companies utilising electric vehicles;

[68] Ibid., p. 35.

- Accelerated capital allowances, in conjunction with the state government, on Nigerian-made Vehicle purchases for companies; 2-years as opposed to the currently existing 4-years.[69]

In 2023, further efforts are being made by the NADDC to distil the EV provisions of the NAIDP (amounting to six pages out of a 60-page document) into a dedicated 33-page National Action Plan for the Development of Electric Vehicles in Nigeria. This draft Action Plan, initiated in 2022, is still undergoing validation and consolidation by the NADDC and proposes a range of subsidies for EV supply and demand, fiscal incentives, public procurement incentives, disincentives for ICE vehicles, skills development measures, infrastructure development measures, R&D stimulation, safety and standards, and other relevant measures.

The plan recognizes several challenges that need to be addressed to establish a functional and sustainable EV ecosystem in Nigeria. These challenges include unstable power supply, long traffic hours, the lack of professional auto repair experts for EVs, the absence of a well-defined organisational structure, and the need for a robust working policy. Government interest is also identified as a critical factor affecting the pace of EV adoption in Nigeria.

These policy milestones over the past three years represent a major step for Nigeria, although a concerted national EV promotion programme and regulatory framework are yet to be developed and launched.

6. Recommendations and Conclusion

The e-mobility and the transport sector in Nigeria generally are going through major shifts which include the fuel subsidy removal, the announcement of the Energy Transition Plan and the launch of the National Automotive Industry Development Plan. Given these indicators, the E-mobility sector is expected to grow at a higher rate in the coming years.

The following are the recommendations drawn that will foster the rapid development of the sector.

[69] Ibid., p. 36.

1. Financing: In light of the rapidly growing market, the issue of securing adequate funding for scaling up initiatives and conducting research has gained heightened significance. Nigeria's transportation landscape is in a state of evolution, particularly with the nascent development of E-mobility. This situation is further compounded by the worrisome emissions rate that the country faces. Given this context, Nigeria stands at a pivotal juncture where it can strategically leverage the carbon market as a potent tool for generating crucial financial resources for the sector's expansion. The carbon market operates by allowing entities to buy or sell carbon credits, creating a market-driven incentive for reducing emissions. This approach not only aligns with global efforts to combat climate change but also has the potential to inject much-needed capital into the burgeoning E-mobility sector. Moreover, the concept of climate bonds introduces yet another avenue for mobilising funds with a climate-focused objective. Climate bonds are debt instruments issued to finance projects with environmental benefits, such as renewable energy and sustainable transportation initiatives. By issuing climate bonds, Nigeria can attract investments from socially and environmentally conscious investors, channelling their funds directly into the advancement of E-mobility infrastructure and technologies. The immense potential of these financial mechanisms for driving sustainable growth, particularly within developing economies like Nigeria is very high. These mechanisms not only address the financing challenges faced by the sector but also align with the global shift towards environmentally responsible investment practices. As Nigeria positions itself on the precipice of E-mobility expansion, seizing these opportunities could prove pivotal in realising a cleaner and more sustainable future for its transportation sector.
2. Working Policy: The initial draft of the EV Roadmap, focusing on policy matters, is certainly praiseworthy as it sets out to propel the adoption of EVs (EVs) in Nigeria. While the foundation is promising, there arises a crucial requirement for enhanced clarity and specificity within the document, particularly concerning the identification of beneficiaries and a meticulous consideration of the distinct market segments within the country. In order to further bolster the efficacy of the roadmap, it is imperative for the government to provide comprehensive and

well-defined timelines for critical aspects such as infrastructural development and the rollout of incentives. These timelines would not only offer a sense of direction and urgency but also foster a more conducive environment for investors and stakeholders who are integral to the success of the EV adoption initiative. Equally important is the inclusion of intricate details regarding potential disincentives and the impending import ban on conventional vehicles. This level of transparency would enable all stakeholders to make informed decisions and adequately prepare for the upcoming changes. By outlining the disincentives, such as higher taxes on internal combustion engine vehicles, the government can effectively steer consumers and manufacturers toward the adoption of EVs.

3. Market Development: As the momentum behind the adoption of EVs continues to build, it becomes increasingly imperative to direct attention toward the comprehensive development of the entire EV value chain. A flourishing supply chain lies at the heart of any successful market, and the EV sector is no exception. Therefore, a concerted effort by all stakeholders within the supply chain is necessary to identify and address the existing gaps, working collaboratively to bridge these divides. One of the primary focuses of market development should be strengthening the supply chain infrastructure. This involves refining processes, enhancing logistics, and ensuring a seamless flow of components and materials to support the manufacturing and distribution of EVs. By optimising the supply chain, manufacturers can reduce lead times, minimise production delays, and ultimately enhance the availability of EVs in the market. Stakeholders across the EV value chain, from raw material suppliers to manufacturers, distributors, and retailers, must be proactive in identifying areas that require improvement. These gaps can range from sourcing quality components for EV production to establishing efficient charging networks and maintenance services. Collaborative efforts can then be directed towards developing innovative solutions, which may involve partnerships with technology providers, research institutions, and government agencies. Equally important is the engagement of stakeholders within the internal combustion engine (ICE) vehicle supply chain. These entities have established expertise and resources that can be strategically repurposed for the EV market. By orienting them towards the potential within the EV sector, they can proactively

explore opportunities for transitioning their operations, whether it's through manufacturing EV components, setting up charging infrastructure, or exploring new business models that align with the evolving automotive landscape. To facilitate this transition, different market models should be explored and communicated to stakeholders. These models could encompass various approaches, such as offering EVs alongside traditional vehicles, setting up dedicated EV dealerships, or integrating EVs into ride-sharing and rental fleets. By presenting these possibilities and providing the necessary support and training, stakeholders within the ICE vehicle supply chain can navigate the transition more effectively. In essence, the development of the EV market goes beyond the vehicles themselves; it encompasses an intricate network of suppliers, manufacturers, distributors, and service providers. By fostering collaboration, addressing supply chain gaps, and guiding stakeholders through the transition, the EV market can mature and thrive, paving the way for a sustainable and electrified future of transportation.

4. Research and Development (R&D) and the Transfer of Technology: Undoubtedly, the significance of research and development in the growth of emerging sectors or technologies cannot be overstated. This is particularly true for the EV industry, which demands an extensive commitment to R&D in order to achieve not only the expansion of the technology itself but also the establishment of its market viability. The role of R&D extends beyond technical advancements; it encompasses a holistic approach aimed at refining the technology, reducing costs, and adapting it to align with the specific needs and preferences of the Nigerian population. In the realm of EVs, research and development serve as the lifeblood that propels innovation. The dynamic nature of technology mandates ongoing exploration and experimentation to unlock new breakthroughs and optimise existing systems. R&D not only enhances the performance and efficiency of EVs but also contributes to the development of novel features and functionalities that can entice consumers and address specific challenges unique to the Nigerian context. Market viability is a pivotal aspect that R&D endeavours strive to establish. By delving into consumer preferences, driving patterns, and infrastructure limitations, researchers can fine-tune EVs to suit the local

landscape. This might involve adapting battery technologies to withstand varying climatic conditions or engineering charging solutions that align with the availability of electrical infrastructure. Ultimately, R&D ensures that EVs are not just technologically advanced but also seamlessly integrated into the fabric of Nigerian society. Moreover, the pursuit of R&D is a potent strategy for cost reduction. As EVs inch closer to cost parity with conventional internal combustion engine vehicles, R&D efforts play a pivotal role in streamlining manufacturing processes, optimising supply chains, and innovating cost-effective materials and components. These initiatives culminate in more affordable EVs, making them accessible to a broader demographic and expediting their adoption. A noteworthy paradigm is the principle of dedicating a portion of profits to R&D. This practice acknowledges the intrinsic link between innovation and sustained success. By earmarking a fraction of profits for R&D initiatives, companies invest in their own future growth and relevance. This commitment fosters a culture of innovation, nurturing a fertile ground for groundbreaking discoveries that drive the evolution of technologies like EVs. In conclusion, the significance of research and development within the EV sector is irrefutable. R&D not only propels technological advancements but also fine-tunes the technology to harmonise with local contexts, enhances market viability, reduces costs, and lays the foundation for sustainable growth. By embracing R&D as an integral part of the journey towards electrified transportation, companies can shape the trajectory of EVs, contributing to a cleaner, more sustainable future while reaping the rewards of innovation-driven success.