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Global Strategy Entry Mode Development: Case study of Electric Vehicle Market in Africa

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Abstract

This research report cuts across management sciences (market strategy entry mode development) and innovative technology (Electric Vehicle (EV)) alongside measures to submerge global warming. The development of a successful entry mode for the electric Vehicle into the African continent is the main objective of the study. The study focuses on an analysis of how electric car manufacturers can enter the African market in other to achieve global sustainability and social responsibility. The methodology is based on identifying the factors that affect the choice of an entry mode into international markets by multinational companies desiring to leverage their revenue through a foreign market. It also offered a quantitative approach that can support the economic and sustainability entry mode model for EVs and a qualitative approach of Porter`s five forces analysis as an entry mode coaching tool for EVs. These proxies are used in quite a wide range of multivariate statistical methods (trend analysis, ratio, and probability, comparative t-test technique, auto-regression, and ordinary least square technique). The result acknowledges joint venture and setting of the plant (physical presents) as the optimal entry mode in African EV market. It requires the EV manufacturers a tire-free emission innovation technology in order to optimize the global sustainability initiative.

Keywords: *Electric Vehicle, Global Strategy, Africa, Porter`s Five Forces, Global Warming*

1. INTRODUCTION

Following the early appearance and rapid decline of electric vehicles in the late 19th and early 20th centuries, air pollution, the climate crisis, and the negative effects of rising oil prices in the 1960s and 1970s reaffirmed the need to go from conventional internal combustion engines to electric vehicles [1]. Electric vehicles (EVs) are generally a very attractive option compared to conventional vehicles due to their high overall energy efficiency, no localized emissions, generally reduced energy efficiency, and reduced dependence on oil imports, quietness, low operating costs, and maintenance. Electricity for battery charging is a fossil, it can be generated from nuclear or renewable energy plants [2]. In addition to input energy, power plant efficiency must also consider inherent energy, preparation, and environmental restoration energy, and all of these reasons are obviously very diverse.

Overall energy efficiency is the result of electricity generation efficiency, electrical transmission efficiency, battery charging and discharging efficiency, which is usually about 75% (or maybe somewhat

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higher), the degree to which braking and mechanical energy are converted back into electricity [3]. The latter regenerative process favors EV efficiency, and the actual improvement is estimated to be around 25%, although it depends on the type of ride and vehicle [3, 4].

EVs were invented as early as the 19th century, but the short range limited by batteries and the current high cost of batteries, if they come to a range similar to that of conventional vehicles, are the main flaws that are preventing their mass use [5]. The combination of battery technology and cost improvements, the prospect of further improvements in the relatively near future, and government subsidies have made EVs a major target for vehicle development around the world. Especially in developing countries and the African continent, Europe, considering that it has served as a dumping ground for used cars and manufacturing defaults in North America, Asia, etc. The world's most powerful economies, including Norway, Germany, South Korea, and parts of the United States, have announced plans to ban vehicles using fossil energy from 2025 to 2027. Others extended the ban from 2050 to 2035 [6].

In the short term, the used electric vehicle market will emerge globally. It is a puzzle to determine whether developing countries are ready for the EV secondary market, whether they have the technology plans and infrastructure in place to support EVs, and whether there are greater technological differences in Africa when EVs are used in earnest in the West. The future path of electric vehicles consists of different technological curves, especially in developing countries where there is little that can adapt to these rapid changes.

Recently, due to the economic impact of COVID-19, automakers have prioritized their businesses, and technological advancements such as electric vehicles have received more attention and subsidies. Many countries have pushed back for several years the target deadline for Level 3 and 4 autonomous vehicles (AVs), which were originally set for 2022 [7]. For example, Volvo's plan to deliver fully autonomous Level 4 systems by 2024 has pushed back the Level 4 target date to 2027 and will now aim to deliver Level 3 AV models in the same period originally planned for Level 4. Argo and Ford have also postponed their robotic taxi and AV programs, promising an additional $28 billion for EVs. The purpose of this paper is to look at the local EV market, identify the guidelines for successful entry decisions in emerging EV markets such as Africa, and propose optimal entry models for global EV producers to these markets [7,8].

This research cuts across management sciences (market strategy entry mode development) and innovative technology (EVs) alongside measures to submerge global warming [9]. The Global automobile industry is aware of the dangers to human survival of the current oven state of the earth planet. This has led to an ongoing global transition from fossil fuel carbon emission engine vehicles to an innovative EVs. Globalization of this initiative by the global automobile firms championed by Tesla, Mercedes and others may go a long way to narrow the destruction of the ozone layer through reduce carbon dioxide emission. The development of a successful entry mode for the EVs into the Africa continent is the main objective of the study. The study focuses to analysis how electric car manufacturers can enter the Africa market in other to achieve global sustainability and social responsibility while sustaining economic performance.

The research questions focused on finding an optimum entry mode development for EV market in Africa, how does the Africa EV market initiative impact global warming and climate crisis, and to what extent does the present labor, employment and living standard conditions offers an entry Push - Pull (Sustainability – economic) force on EV firms.

The methodology was based on identifying the factors that affects the choice of an entry mode into international markets by a multinational companies desiring to leverage its revenue through a foreign market. It also offered quantitative approach that can support the economic and sustainability entry mode model for EVs and a qualitative approach of the Porter`s five forces analysis as an entry mode coaching tool for EV. Thus a mixed method analysis was adopted to develop an entry mode model to the research problem.

After a review of global entry strategies (exports – dealers, wholly own subsidiary and joint ventures, franchise and licenses, partnership and collaboration), the methodology path the study into sustainability and economic Africa entry mode orientations. Sustainability entry mode decision center on the analysis of carbon dioxide emission and a possible job offering opportunity while automobile unit sales, the labor markets and living standard conditions are the core economic proxies. These proxies are used in quite a wide range of multivariate statistical methods (trend analysis, ratio and probability, comparative t test technique, auto regression and ordinary least square technique). In additional to the applied quantitative tools, the porter five forces qualitative analysis is conducted to picture the attractiveness of the Africa market for global EV firms. The findings (95% significant level) confirms a possible positive significant reduction of global carbon emission from the efforts of EVs in Africa [10]. The results reveal a significant presence labor force but need

training without which it may weaken the sustainability goal. It also surface a significant positive role of improve leaving standards on the revenue and margins of automobile industry.

The result acknowledges joint venture and setting of plant (physical presents) as the optima entry mode. This is because it is able to support the carbon reduction initiative, help in job creation and improve wellbeing while marking use of the labor force, lithium, manganese and other raw materials. It is also argued that physical presence job creation potentials can help in the global migration crisis especially along the Mediterranean Sea or across the Mexico jungle. The study summarized suggestions into mountains, efforts and cautions. Limited infrastructure and lithium, corruption and violence across the continent and market unattractiveness due to high consumer bargaining power are some of the mountains 11]. Sensitization, advertisement and setting of charging stations are some of the needed efforts to lower the heights of the mountains. It is optima to avoid quality fade and morality fade strategies since an attempt to sustain high margins may invite such unethical business practices. It requires the EV manufacturers a tire free emission innovation technology in order to optimize the global sustainability initiative.

2. THEORY

Among other developing countries, Africa is slowly formulating sustainable plans for EVs, still citing the necessary approaches related to EV product technology, battery industry, market research, consumer behavior, policy, infrastructure, and cultural implications' [12]. These interpretations help us understand that EV challenges in Africa are not driven by a single factor such as price or technological change, but usually involve co-evolution between multiple developments.

African countries account for 95% of used car consumers. Most (if not all) of them are still completely absent in internal combustion engine cars [13]. Even the top two of Africa's 11 automakers (Morocco and South Africa) still have high production of vehicles with internal combustion engines. Example: In South Africa, out of 2 million cars driving on the streets, only 1,2 are electric. The average lifespan of an imported used car in Kenya is 1 year. In Ethiopia and Nigeria, most imported vehicles are more than 7 years old. One-quarter of the vehicles imported into Nigeria is more than 11 years old. Cape Verde Island has decided to stop importing used cars by 4 [14]. Only South Africa, Egypt, and Sudan have completely banned the import of used cars. However, due to the high reliance on used car imports and major infrastructure constraints, the path to EVs is much less clear in many African countries (table 1). Since EVs are in their infancy on the European continent, most countries have yet to set incentives for EV deployment, such as free charging stations and green bank loans [15,16]. However, some countries have taken some initiatives that have the potential to boost EV demand. Moreover, favorable government policies and incentives will provide lucrative opportunities for key players to promote the adoption of electric vehicles in the coming years in the region.

Table 1. List of Electric Vehicle startups in Africa

Startup	Founded	Country	Capital	Overview	Last round
Shift EV	2020	Egypt	$9,000,000	An electric mobility startup with mission to electrify fleets in emerging markets, a decade faster	Series A
Ampersand Electric Motorcycles	2014	Rwanda	$13,990,850	A startup with mission to make better, cheaper and more powerful electric motorcycles taxi in E. Africa	Debit financing
Opibus	2017	Kenya	$7,500,000	A startup with mission to accelerate the transition towards sustainable transport and energy solutions	Seed
BasiGo	2021	Kenya	$5,300,000	An e-mobility start up to create the future of clean electric public transit	Debit financing

Mobility for Africa	2018	Zimbabwe	$2,000,000	A social enterprise committed to creating transport solutions for rural and Peri-urban communities	Seed
Zembo	2018	Uganda	$4,900,000	A start-up with mission to pave the way to e-mobility in Africa	Grant

Source: https://startuplist.africa/industry/electric-vehicle [17]

The African continent is also part of a growing wave of electric-powered transport. Several African countries, such as Kenya and Rwanda, have adopted tax incentives to encourage the import of EVs and are working to develop their own electric two-wheelers and tricycles [18]. The growing focus of governments across the region to promote the use of EVs and the growing awareness of energy storage solutions in the renewable-based power sector are expected to drive the market during the forecast period. Several countries are already capitalizing on this potential. Rwanda's Start-Ampersand is introducing electric motorcycle taxis in Kigali and plans to expand to other East African countries. In Uganda, Kiira Motors' "locally manufactured electric buses have started transporting passengers from Kampala" [19]. Unlike most developed countries, where government policies are forcing the automotive market to adopt climate-friendly options such as EVs, most African governments are more laid-back.

A startup in Namibia is offering ebike4africa supplying electric bikes to the tourism market, and finally, Jet Motor Company in Nigeria is partnering with GIG Logistics to provide EVs for transport and logistics services in the Nigerian market. The growing demand for electric vehicles in the region has led to companies such as Tesla Motors, Volkswagen AG, Toyota Motor Corporation, and Nissan Motor Company. Ltd and Gelly "have entered into partnerships, joint ventures, and acquisitions with major players in the market" [20,21].

Although the EV market in Africa is in its infancy, various key players in the market are working to build new facilities for product development, increasing their presence in the market. In October 2019, Volkswagen and Siemens agreed to launch an electro-mobility feasibility project in Rwanda, East Africa, to increase their presence in the African market. On November 10, Photon Motors began localizing the production of AUV pure electric buses with new energy technology in Cairo, Egypt. Other major players in this market include Ford Motor Company, Group PSA, Kia Motors, Group Renault, Daimler AG, BMW, Hyundai Motor Company, BYD Company, and Continental AG. In February 2019, Rubicon, a South African provider of commercial solar components and solutions, announced that it was bringing the Tesla Model X Performance Edition all-electric SUV into the country to emphasize its focus on domestic electric mobility [22].

In June 2020, Nissan announced a four-year business strategy for the Middle East, Africa, and India. As part of this strategy, Nissan plans to introduce eight new models, focus on key segments, invest in highly profitable products, and give regional priority to sport utility vehicles (SUVs) and affordable sedan models (B-sedan segment) (figure 1).

Figure. 1 Electric Vehicle industry statistics 2014 - 2021 (African region)
Source: https://statista.com (last accessed as of march 2023) [23]

Global markets are habitually studied as part of international distribution networks, especially in production chains and distribution systems [24]. In most cases, companies and/or industries in the global market are described as "dedicated service industries that connect domestic producers with overseas buyers" [25] (p. 19).

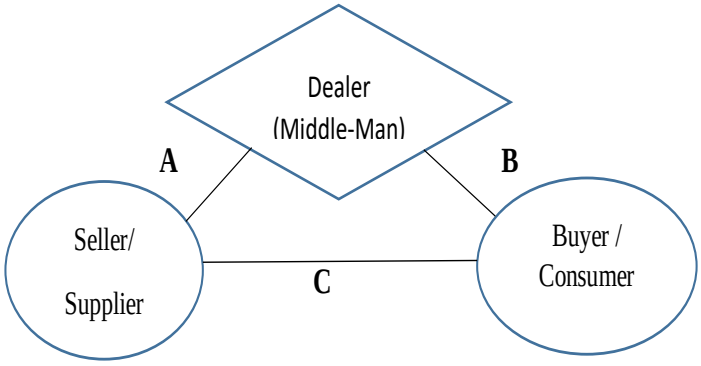

Figure 2. Triad structure
Sources: Adapted from Fung et al. (2007) and Havila et al. (2004) [26,27].

As shown in Figure 2, the relationship between the supplier (seller), the consumer (buyer) and the dealer (middle-man) in a business environment. The consumer is an entity that purchase goods and services for consumption. The supplier is an entity sells goods and services for profit. The Middle-man is an entity that buys and sells goods and services for profit. The relationship between the seller and the buyer is a transactional, while the relationship between the dealer and the seller/buyer can be transactional or strategic partner sales. Here, both sides invest resources and share their expertise to build solutions that jointly grow each other's businesses. This simply means that there are commercial intermediaries who benefit from transactions between buyers and suppliers. "The business environment in which global companies now live is far more multifaceted than the turmoil" described by Achrol [28]. This opinion is due to the increasing dizziness of globalization. From the perspective of Ellis "the globalization of general and international businesses is a serious threat to domestic companies" [29]. Ellis supports his idea by arguing that new technologies for transportation financial systems and communications combined with the new globalization of companies and dealers have triggered many outdated functions of international distribution (figure 2).

3. METHODOLOGY

3.1 Scope of research

The scope of this study is based on the challenges faced by Africa to adapt to electric vehicles despite the increasing world market shares. An EV operates on a rechargeable electric battery. Therefore, such a vehicle is seen as a possible replacement for current-generation automobiles to address rising pollution, global warming, and depleting natural resources. It covers the continent as a whole and is guided through sustainability and economic orientation. It seeks statistical evidence to support the need for EVs to enter the continent base on the notion of reducing emissions. In a similar picture, it deviates also economics from the sustainability business model to find economic reasons to justify an entry mode. Physical present's entry mode (setting up of plants, either as joint ventures, wholly owned, partnership, and others) is considered likewise nonphysical entry techniques like exports, franchises, and others. The African automobile industry is reviewed; however, analysis and entry mode decision is associated with EV technology since it is new and not fully embraced and functional in the continent. Though the study is centered on EVs, it spread to have some reports about hydrogen, hybrids, and other emission-free oriented auto production. It should not be surprising to have the report mention automatic vehicles and taking off and landing innovation within the industries. This may just explore existing progress within the automobile industry while centering on EV technology. The research design further shows some delimitations to the study in terms of data, method, and type of research applied [30].

3.2 Research design

The concepts of Economic (profit) and sustainability orientation entry mode justification were created themes (thematic) designed to show why some firms may choose one entry mode over another. However, these were not analyzed through the thematic tools in qualitative and descriptive analysis but through comparative and relationship techniques. The use of the existing five forces to raise qualified discussion for entry mode formed an aspect of narrative argumentative research. This alone could not resolve the EV entry mode puzzle except the relationship between sustainability and economic variables was established. To establish the relationship, a date set over a justifiable time interval is required and qualified its trend research contributions. The research is not only mixed by its qualitative and quantitative methods but also by its multivariate statistical techniques applied to answering the research problem. Mengual-Macenlle and Marcos and Golpe and González-Rivas recalled "multivariate statistics used in this report as a tool needed to process big data especially when it requires a causal study" [31]. The report met the description since it is not built on a single time series data set but on panel data across varied classes of variables (figure A1 appendix A).
Based on theoretical review and market analysis three hypothesis were developed together with support research questions:

H01: *The present external market factors have a significant entry Push - Pull (Sustainability – economic) force on EV firms*
RQ1.1 What are the main external market factors influencing the African EV market?
RQ1.2 Which entry mode strategy model could be sufficient for the EV market in Africa?
H02: *Wholly Own Subsidiary and joint ventures (physical present) entry mode has a significant difference in C02 emission*
RQ2.1 What are the most common types of entry modes in the African market?
RQ2.2 What are the risks and opportunities of entering the African EV market?
H03: *The present labor, employment and living standard have a significant entry Push - Pull (Sustainability – economic) force on EV firms*
RQ3.1 Which trends of the African region market may have an impact on the EV industry?
RQ3.2 What are African market initiatives toward global warming?

3.3 Data collection and analysis

In the EV market in Africa, PESTEL analysis reveals that the market is driven by severe government regulations. In a collective effort towards the UN sustainable goals, consumers' concern about global warming, polluting emissions from vehicles, and environmental issues have shifted their interest towards EVs. In

addition to these concerns, some African countries (South Africa, Rwanda, and Kenya for example) are offering incentives to automobile users to switch to eco-friendly vehicles and also offer electric vehicle charging services at affordable rates [32]. All these factors and more, are paving the way to an increasing sales in the EV market.

However, the EV market in Africa has some major challenges. One of the major challenges in this market in Africa is the significant investment required for a power grid system to support the growth of the EV market. Another critical challenge is charging infrastructure and upgraded battery technology which ensures that EVs travel longer distances and reduce charging time. Notwithstanding the challenges, renewable energy sources are an exceptional opportunity for the EV market in Africa. Gas-Electric engines (plug-in EVs) are very flexible in range and charging speed as they use both gas-powered engines and electric-powered engines (table 2).

Table 2 shows the external factors of the PESTEL-SWOT analysis with eleven opportunities and six threats in the EV market in Africa. The opportunities indicates government regulations encourage the adoption of Evs and that consumers are leaning more toward eco-friendly vehicles. The threats indicates the barriers and market competition factors that discourages the entry of new EV firms. The higher number of market opportunities that market threats indicates the attractiveness of this industry in the African market.

Table 2: Summary of integrated PESTEL-SWOT analysis of EV market in Africa (based on data from Appendix B Table B1)

Effect on business	*Number of factors (in total)*	*Areas*	*Examples*
Opportunity (positive effect)	11	Legal -2 Political -1 Economic -2 Social -2 Environmental – 3 Technological - 2	- The government of Rwanda, South Africa, and Kenya offers Incentives to consumers who switch to eco-friendly vehicles. -Technologically advanced vehicles are attracting more consumers due to their low maintenance costs, eco-friendliness, and fuel efficiency
Threat (Negative effect)	6	Legal -1 Economic -1 Social – 2 Political -1 Technological -1	- The development of alternative fuels, such as hydrogen, may compete with EVs in the future. - - Awareness and acceptance of EVs in Africa may be limited, which negatively affects demand for EVs. - The lack of charging infrastructure may limit the growth of the EV market

Source: Made by Author

The quantitative analysis was conducted with the notion of economic (profit) and sustainability orientation of EV entry mode into Africa. Boslaugh suggested "knowledge and publication on the practical guides towards secondary data gathering process and data analysis was used to guide the experimentation journey" [33]. This report supported the two-axis data-gathering process which strengthen the qualitative argument justifying the pull-push factors for EV analysis

Sustainability orientation embraces corporate social responsibility, a future-oriented strategy. C02 was the identified proxy needed for the sustainability entry mode orientation. The choice of revenue (economic) and C02 (sustainability) variables was driven by the availability of the data points. The CO2 proxy was collected for Sub Sahara, Europe, China, and North America and used to support the trend, ratio, comparative and econometric analysis. Muijs issued second-edition book on "how to conduct quantitative data analysis using the IBM SPSS application guided that data experimentation" [34]. Significant different levels of CO2 between the other regions compare to Sub Sahara offer an objective attractive justification for the EV market in Africa. Africa may be used as the central point of fighting global warming. This raised proposition was the reason for the comparative CO2 emission by regions. The difference in CO2 emission among the four regions

was analyzed first through the trend or historic time graph and second, using a 95% significant level paired t-test (table 3).

Table 3 shows that economic variables like market potential, inequality and living standard and proxies such as revenue, income gap, and GDP and employment rate were used to check for trends and their effects on the EV market in Africa. On the other hand, carbon dioxide emission was used as a sustainability variable to showcase the attractiveness of the continent to EV firms.

Table 3: Operationalization of the Research Variables

Orientation	*Variable*	*Proxy*	*Category*	*Use*
Economic	Market potential Inequality Living Standard	Revenue Income gap GDP per capital Employment	Predictor Predictor Control Control	Trend and causal
Sustainability	Carbon emission	CO2	Criterion	Trend/Charts Comparative Ratio (%) Causal

Source: Author`s carve out Methodology process

Three sets of CO2 emissions (through solid fuel, liquid fuel, and industry and construction as a ratio of fuel) were gathered for this purpose. The ratio of industry and construction to fuel emission was an excellent indicator of an entry mode decision. This is because, either way (stop the use of fuel-engine cars and build factories for EVs), CO2 emission is never going to be zero. This opened a judgment on whether export or wholly owned subsidiary be the preferred decision for EV future investors in Africa. A two-way econometric regression model was designed to check the causal relationship between the economic and sustainability orientation of entry mode decisions. In either equation, employment, income inequality, and living standard were used to control the equation. The data set used at this level was a 7-year (2015 – 2021) automobile revenue against carbon emission figures, income inequality, GDP per capita PPP, and employment for the region within the same interval [35]. The difficulties of having EV revenue data points for the unit of research pushed the study to apply the available figures for engine fuel cares. The results aimed to prove either a concession or tradeoff between emission and revenue of the EV industry is interpreted through inference.

A car may be considered a necessity by others but in most cases, it views as ostentatious good, therefore requires improved income for many under the poverty line to enjoy EV innovation. Closing the inequality gap and improving living standards within Africa may be a stimulus to the demand for this product. The raised argument permits the study to introduce the variables into the relationship between economic and sustainability entry mode orientations. In a similar not employment challenges may be weakened when EV firms engage in subsidiary entry since they may hire nationals. That was the reason the study pointed at AI and humanoid robotics as an issue to employment if robots rather than Africans were to be considered to satisfy the need for labor. Two ordinary least square regression equations were utilized to measure on one hand the drivers of sustainability and on another economic orientation of EV entry mode.

$$Y1t=a+b(X1)+c(X2)+ d(X3)+ e(X4)+ \varepsilon \quad (1)$$

$$Y2t=a+b(X1)+c(X2)+ d(X3)+ e(X4)+ \varepsilon \quad (2)$$

The first equation regressed revenue (X1), income game (X2), Living standards (X3), and employment (X4) against carbon emission - C02 (Y1t). The second model sought to study how changes in Carbon emission – C02 (x1) income game (X2), Living standards (X3) and employment (X4) can affect revenue (Y2t) of the car industry in Africa. The letters a, b, c, d, and e reflected the sensitivity of each of the variables while ε represented the error term. After optimizing the use of co2 emission by industry and construction as a

percentage of fuel to make an entry mode decision, this econometric model further strengthens why there may need to set up EV factors in the continent or better still engage in a joint venture or specialize in exportation.

4. RESULTS

Three distinctive elements of each of the five forces of the zero-emission car design are noted and presented in Table 2. In line with the threat of new entry, innovative automobile technology requires heavy capital to enter the African market. The huge capital requirement may support a specific entry mode like export than other physical present modes. Other factors may guide the entry mode decisions for high-capitalized multinational EV-oriented firms like Tesla, Hyundai, and other Eastern firms [36]. However, the need to be everywhere may pulse a capital issue, hence entry into the African market and capital allocation decisions may still be necessary. Limited barriers to entry except may lower the threat of entry from the huge capital requirement. Limited or no barriers because the Africa Union and the national governing bodies are engaged and aligned to global connectedness and support for greenhouse emissions. These two goals may not support the rejection of FDI that promotes a zero-carbon emission car design. It should be noted that EV firms are physical in a few African Nations. It is possible to set a plan in the CEMAC region and other nations of the four cardinal points of the continents. This again opens a window of entry since the market seems not saturated, though saturation does not mean physical presents (figure 3).

Figure 3, the threat of a new Entrance shows that the huge amount of capital needed to enter this market limits the number of companies willing to explore the EV market in Africa. In addition, the presence of limited or no barriers in some African countries and very few EV companies could facilitate a new EV company's willingness to enter the market because of weak or no regulations governing the sector. In the threat of Substitutes, the number of fossil-engine vehicles still booming on the continent and upcoming hydrogen and solar-powered vehicles could reduce the profitability of the EV market. In the bargaining power of consumers, Africa has a large population that can consume electric vehicle products and a high unemployment rate shows that it has the labor force to work in this industry. However, there are very few middle- and high-income earners that can afford electric cars. Supplier bargaining power shows Africa has abundant raw materials used in EV and battery manufacturing. This Boosts EV Companies' Supplier bargaining Power in Africa's EV Market. The potential competition (rivalry) is high as six local EV companies and a number of global EV manufacturers are already exploring the market through exports and various partnerships.

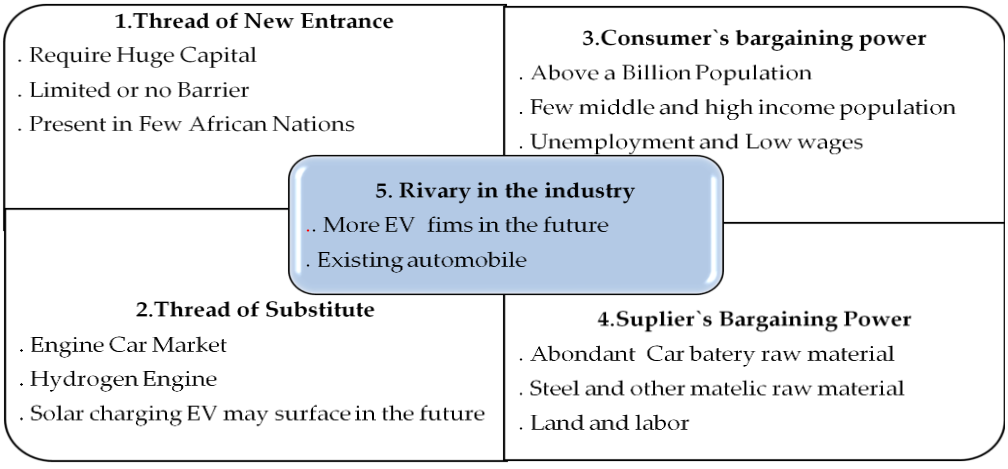

Figure 3. Five Forces Analysis for African EV market
Source: made by author

The rival in the industry is discussed along the axis of a number of EV manufacturing firms, the current state of the automobile industry, and the possible automobile evolvement. The may be many brands of EV cars

in the continent due to export entry strategy, however, they are just about six set-up production plants in the continent. There are those that can avoid the noted double transport issue in exportation (raw material and finished goods). The first layer of competition analysis begins within the six noted firms but with the possible international competitors and other non-electric vehicle manufacturers. It may be argued that EV product is not a direct competition with fossil fuel since they have different business orientation, mission, and vision. One may be following the premium strategy while the other low cost and easy buy strategy. In this regard, engine fuel has its market segment out of the niche of the EV industry. If this argument is true, then competitive analysis stays within the six firms. However, if doubtful, the degree of competition cuts across the automobile industry. Sound logic may argue that as long as they can be substituted for another, EVs and fossil-engine cars are still in the competition. The protagonist may suggest that the global warming and sustainability orientation of electric automobiles makes them stand out from the competition with the engine economic and profit-oriented fossil automobile products. To narrow the dispute, automobile firms desire to profit, but in a different orientation, hence having some degree of competition (table 4).

Table 4. Probabilistic Quantification of the African EV Market

A force	*Elements*	*Description*	*Effect Probability*	*Average (range)*	*Decision*
Threat of new Entrance	Capital Requirement	Huge	Low (0.20)	0.62 (0.5 - 0.79)	Moderate Attractive
	Barrier	Limited/none	High (0.85)		
	Present	Few nations	High (0.80)		
Threat of Substitute	Old Substitute	Engine Fossil Fuel	High (0.90)	0.50 (0.5– 0.79)	Moderate Attractive
	New substitute	Hydrogen Fuel	Low (0.4)		
	Future Substitute	Solar	Low (0.20)		
Consumer`s Bargaining power	Population	Above 1 Billion	moderate (0.6)	0.81 (0.8- 1)	High Not Attractive
	Income levels	Few high-income earners	High (0.88)		
	Conditions	Unemployment and Low wages rate	High (0.95)		
Supplier`s Bargaining power	Size	Large battery raw material	Low (0.35)	0.30 (0-0.49)	Low Very Attractive
	Land and Labor	Huge	Low (0.40)		
	Other material	Present of steal and others	Low (0.15)		
Rivalry In the Industry	Number of firms	6	Moderate (0.7)	0.72 (0.5 -79)	Moderate Attractive
	Competitors	Engine Fuel	Moderate (0.6)		
	Industry features	Free Entry	High (0.85)		

Source: made by author

The threat of new entrants to the African EV market was noted to be moderately attractive after a mix of subjective (theoretical) and objective (numeric) probability allocation. The Morocco Stellantis factor cost about dollars 650 million and may stand above a billion dollars in others. This huge capital requirement supports a projected low (0.2) threat of entry. This could have offered a high attractiveness to the industry but the limited barriers and restrictions FDI into the continent (project high value of 0.85) and the limited presents of EV manufacturers in a few nations (0.80 probability) low its attractiveness. Very few nations will hinder EV subsidiaries into the continent due since it has a positive economic impact like improving industrialization, jobs, and tax revenue to the government. In a similar argument, EVs seem to be found in African nations with

formal automobile plants like South Africa, Morocco, Egypt, Ghana, and Kenya. It is easy for any new EV firm to have its way into nations of the CEMAC economy without even an assembling plant. The average (0.62) supported by the raised facts does not offer a low nor very high threat of entry. It rather makes the market attractive at a moderate level (0.5 – 079) for any prospective EV investors of the manufacturer [37,38].

It cannot be denied that the fossil engine industry remains a high threat as a substitute to the EV firms in Africa antagonized since statistical numeric. South Africa has a 2022 ratio of 1000 Electric Vehicles to 12 million traditional (combustion engine) automobile registered cars. Kenya on the other hand has a 2022 ratio of 350 Electric Vehicles to 2.2 million registered cars [38]. This offers numerical evidence supporting the 0.9 threat of substitute between the old and new design. It is very easy following the economic situation for many Africans to keep on the traditional car purchase compared to the EV that seems premium and expensive. This may be lowered in the future with some improved leaving and better environmental protection education. The industry will have been unattractive if this is the lone considered indicator of threat to substitute. Another substitute for the electric car industry is the hydrogen-designed engine fuel sport, passenger, and commercial cars. This innovation had existed since 2005 but was unable to gain much recognition and acceptability like zero-emission EV products. It may be a threat within the African industry but low (0.4). Hydrogen engine fuel has been almost an 18-year-old innovation and has been used mostly in the West to substitute the carbonated fuel engine. It is yet to be popular compared to the EV automobile in the continent of Africa. The project solar charge auto innovation is not a current threat to the electric car market in the continent but such innovation may surface in the future. The raised proposition of a low 0.2 threat of substitute from the proxy. The average of three indicators falls within the range of 0.5 – 0.79 (0.05) hence moderately attractive

The five forces analysis noted market unattractiveness at the axis of consumer bargaining power. Based on the evaluation of the market the right noted a high probability (0.81) of consumer`s bargaining power. The African continent is as large as the Chinese, Europe, and North American markets in terms of total population. The issue is the income discrepancies between these regions and Africa. High-income nations will normally have high purchasing power compared to low-income economies. The size of the population is not equal to the size of the customers. It needs marketing and income factors to convert the population to buyers of EV products. It is rather fortunate that the work structure in the West warrant most of the employees to own personal cars in order to ease transportation.

4. DISCUSSION

Statically, the result confirms a significant difference between Africa's C02 solid and liquid emissions from that China, Europe zone and North America. This is a strong position to raise Africa as an effort hub for the climate crisis. This aligned with the recent award to Gabon for its global warming reduction initiative. It offers a strong ($p\ 000 < 0.05$) and not a moderate nor low significant difference through a 7 years data point (a degree of freedom value of 6). This entails at a 95% significant level, there is a huge gap between the emission from the other members of the sample and the sub-Africa region. It may not be wrong if China engages in SWAP financing policies with Gabon to support its own efforts towards the climate crisis. Gabon should be trusted with the required financial assistance if it has proven to the international community as a caretaker of the human nightmare [39].

It may be of added advantage if an EV plant is set up in the central African nation of Gabon to support its global sustainability efforts. This raised global sustainability idea is supported by the strong significant difference between the total emissions of the sample regions to that of Africa [40]. And also because Gabon is already doing much in reducing atmospheric pollution. Adding more weight to descriptive findings, the t-test result indicated a strongly significant difference ($p\ 000 < 0.05$) in total C02 emission from China, Europe, and North Africa to that of Africa. This is the foundation of a physical present entry mode decision backup by sustainability orientation. As stated earlier, the tradeoff induction emission and emission from fossil fuels is a call for concern. Entry into the African market by EV firms through joint ventures and subsidiaries will require building plants which also leads to some emissions [41].

5. CONCLUSIONS

EV firms are striving to take the car industry out of the emission equation so that a balance can be created between the recycling photosynthesis process and the human respiration process. The rapid population

is a serious problem contributing to the current oven earth. Population growth comes with developmental projects, industrialization, and deforestation which is able to distort the neutralization recycling process. The world may be safer if part of it is left behind in development and industrialization. Africa can therefore be the center of EV sustainability initiatives. The high presents of sunlight within the contents correspond to the raised justification. The sun and the green chlorophyll in leaves are also input factors to the neutralization process of photosynthesis. The Temperate and poles may only be supported by others in terms of fresh air or oxygen during winter seasons since trees seem inactive during this period in these areas. This is the right time for all manufacturers and multination organizations to prioritize the African continent in their philanthropies dimensional of social responsibility. Africa can be a good area for global EV technology to partner in their ongoing visionary strategy since it is rooted in sustainability ideology. The auto-regression equation confirms this assertion since it shows a significant effect of Africa to world emission ratio on the total global emission. This entails that if we reduce the over-emission from the continent from the actions of EV firms, it is possible to lower global warming.

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APPENDIX A

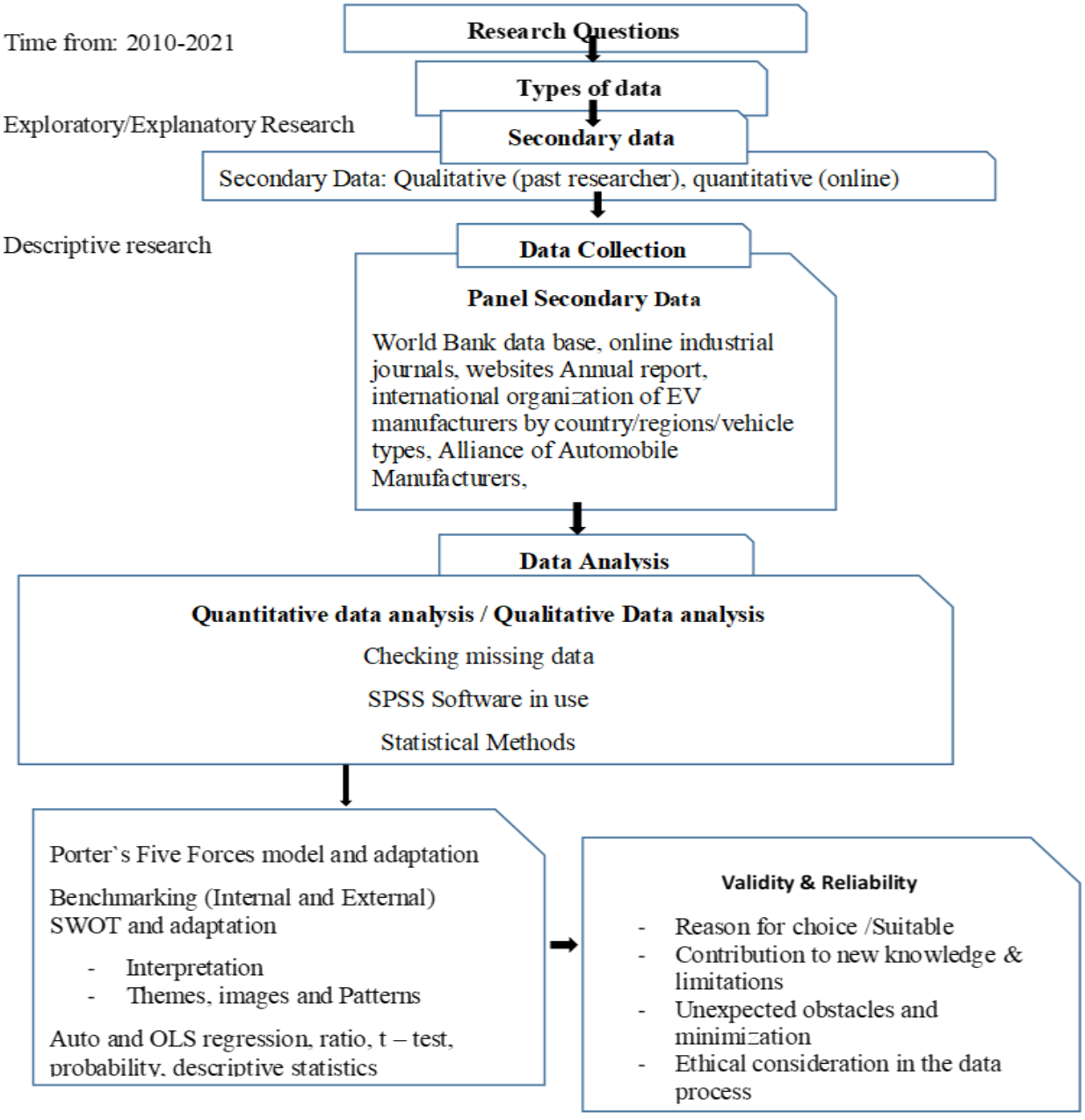

Figure A1 Research design
Source: made by author

Appendix B

Table B1: Key market indicators in the African EV market

Market indicator	2018	2019	2020	2021	2022	2023	2024	2025
Population (in billion #)	1.1	1.2	1.2	1.2	1.2	1.3	1.3	1.3
Price level (Transportation)	63.0	61.3	60.7	57.5	48.2	40.0	39.0	39.4
Gross Domestic product (Investment % of GDP)	23.6	24.5	22.8	23.2	20.7	20.6	20.3	20.1
Infrastructure (Road investment % of GDP)	8.5	8.8	9.3	8.5	8.0	7.8	7.4	7.1
Consumer Spending (per Capital Vehicles purchase)	31.7	32.4	32.1	37.7	38.4	39.2	40.9	42.8
Electric Vehicle Revenue Growth (in percent)	-	266.3	-13.4	48.6	96.8	32.5	31.0	31.2
Consumer Price Index (In thousands)	0.1	0.1	0.2	0.3	0.9	2.4	3.8	4.8
Average EV price (in thousands USD)	46.83	50.68	51.21	43.96	45.73	45.83	45.91	46.01
Electric vehicle Sales (In thousand vehicles)	0.03	0.17	0.16	0.14	0.35	0.48	0.63	0.84
Charging Stations Revenue (In million USD	0.00	0.00	0.00	0.01	0.01	0.02	0.05	-

Source: Made by Author from data from www.statista.com [23]