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TRANSITIONING FROM FOSSIL FUEL TO GREEN TECHNOLOGY VEHICLES: A STUDY OF DRIVERS' PERCEPTION IN IKEJA AREA OF LAGOS

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Abstract:
Despite decades of progress for alternative and low-carbon fuels and technologies, and some incremental improvements that have taken place in the mobility industry, most developing countries remain locked-in to fossil fuel-powered auto-mobility. Studies have shown that some of the challenges of climate change can be mitigated by the use of green technology vehicles in commercial road passenger transport. In order to achieve this, the drivers' perception of green technology vehicles available for road passenger transport e.g., compressed natural gas (CNG), solar and battery powered vehicles will need to change because action will be influenced by their perception. While some consumers may be willing to purchase environment friendly products like Green Technology Vehicles (GTVs), they may face constraints or conflicts that create a resistance to adopting pro-environmental behaviour. This study seeks to investigate the factors limiting the transition from the use of fossil fuel-powered vehicles to the use of GTVs and analyses present perceptions of the drivers regarding use of green technology vehicles. A survey research design was used to determine driver and vehicle characteristics and the perceptions of 411 drivers in Ikeja area of Lagos. The results indicated that 51.3% were unaware of GTVs and factors like availability of GTVs, the presence of fuelling/servicing and maintenance stations, and that the initial cost of the purchase would be subsidized were enough to make the transition from fossil fuel vehicles to GTVs.

Key words:
Green Technology Vehicles, Fossil Fuel, Climate Change, Drivers, Ikeja Lagos

1 INTRODUCTION

Globally, there has been progress in the areas of alternative and low-carbon fuels and technologies and of some incremental improvements that have taken place in the mobility industry, most developing countries remain locked-in to fossil fuel-powered auto-mobility (Axsen, 2019). Climate change is the major reason for prompting a transition from fossil fuels to renewable energy. Such transition can be referred to as a process that replaces current fossil fuel dependent systems with clean/green energy (Mutezo and Mulopo, 2021). In the transport sector; because the severity of some of the impacts of climate change can be mitigated by the use of green technology in commercial road passenger transport, investigation of how progress in these technologies is being taken up in various areas is important to understand. For there to be progress, drivers' perceptions of green technologies for powering vehicles available for road passenger transport [e.g., compressed natural gas (CNG), solar and battery powered vehicles] must be current because their actions will be influenced by their perceptions. Factors that motivate drivers to transition from conventional fossil fuel-based vehicles to green technology vehicles were pointed out by Sanchez (2018) to include: the initial cost of vehicle purchase, long-term cost, charging speed, life cycle and the rate of CO_2 emissions. Internationally, there has been a considerable increase in research on the perception of drivers regarding GTVs and its adoption over the last few years; however, there appeared to be no relevant study that presented the perceptions of GTVs and the transition process among Nigerian drivers. In addition, most studies focused on aspects of private mobility and not road passenger transport. This study, which focuses on perceptions of GTVs for public transportation, should thus be of great interest to the sectors of the business community engaged in manufacturing, maintenance and sales of vehicles powered by alternative sources of energy. Algeria, Nigeria, Morocco, South Africa and Egypt according to Mutezo and Mulopo, (2021) are popularly referred to as Africa's Big Five. These countries are the biggest consumers of fossil fuels for energy generation. Nigeria has the largest population in Africa and by extension has the largest number of vehicles on the roads and a great contributor to GHGs in Africa **(**Lagos Bureau of Statistics (LBS), 2016**).** This act is no longer sustainable if the global community is to achieve: SDG 13 (Climate action); Paris agreement; 50% emission reduction by 2025 and net zero emissions by 2050.

The use of fossil fuel vehicles should not be sustained. There has to be a switch of vehicle infrastructure from fossil fuel to environmental friendly energy. Although there is a new government policy on switching transportation infrastructure from fossil fuel to compressed natural gas (CNG), batteries and solar energy but the question is: How prepared are the Transport community? It is on this premise that this study seeks to assess the perception of drivers in Ikeja local government area of Lagos. The study also identifies at least some of the factors limiting the use of GTVs in the passenger road transportation sector. The ultimate outcome of our investigation of the perceptions of drivers towards the use of green technologies as a climate change mitigation technique is thus intended to help promote the use of green technologies to help moderate climate change.

2 METHODS AND METHODOLOGY

Green Technology Vehicles (GTVs), also known as ecological vehicles, are vehicles whose use does not affect the environment negatively. In GTVs, this is accomplished by minimizing the presence of polluting gases in the atmosphere (CO_2, CO, NO_X, unburned HC and of compounds containing lead and sulphur). By convention, these vehicles do not operate on gasoline or diesel (Environmental Protection Agency (EPA), 2019**).** Alternative-fuel

vehicles are a class that includes hybrid vehicles, vehicles that are powered by compressed natural gas (CNG) and E85 vehicles (that is, they are powered by a mixture of ethanol and gasoline in an 85:15 ratio). Many of these alternative fuels "burn" cleaner than gasoline or diesel and therefore reduce tailpipe emissions. A study by Oncel (2016) pointed out that the increasing scientific evidence affirming anthropogenic factors as the primary cause of ongoing climate change is compelling governments to take aggressive steps to deal with pollution and environmental problems. As a consequence, investors and financiers are therefore starting to fulfill their roles and responsibilities by allocating more capital to sustainable (greener) areas of the industrial sector, including for renewable energy, clean transportation and sustainable production. According to Bellis (2019), Green Technology offers humanity the best hope to limit the impacts of climate change and pollution. According to Ansar and Monika (2019)**,** GTVs promise to be a key game changer. The problem, however, is that many people are not aware of them or at least cannot purchase them for one reason or another. At the same time, the majority of global discussions about dealing with the key environmental issues and policies all highlight transportation as one of the major sources of pollutant emissions and energy consumption. A study by Bennett, et al. (2009), pointed out that the attention given to the mobility industry is understandable, especially because of its size, growth rate, and presence in our day-to-day living in addition to the adverse consequences emissions from this sector are imposing on the environment.

By growing convention, the term “green” here includes the need for the healthy integration of humans and their activities with nature in order to ensure a flourishing future. According to Maheswari and Sakthivel (2015)**,** the evolution of “green” has had three phases. The first phase focused on "Ecological" considerations; the second phase focused on "Environmental" considerations, and third phase is focusing on considerations of being "Sustainable," a term that became popular during the late 90s and early 2000s. Successfully going green will only be achieved by focusing on the fact that neither fossil fuels nor the renewables will be the answer if they are not incorporated in a proper way; in other words, humans are the ones are responsible for all outcomes. Taking this perspective has the potential to open new gates while at the same time supporting and motivating the energy industry to go “green” without any reservations.

Perception

Over the last few years, there has been a considerable increase in research on the perception of drivers regarding GTVs and their adoption. In a recent study conducted by Masurali and Surya (2018)**,** most people were found to be aware that electric cars emits less carbon dioxide and are eco-friendly, but they show relatively low awareness regarding high efficiency and reduced maintenance costs. The authors also found that people perceive that the price, maintenance costs and recharging time are comparatively high for electric cars. People also perceived that the available types and resale value of electric cars is low when compared with vehicles powered in the more traditional ways. They opined that the education of the people plays a major influence regarding public awareness level, and they pointed out that performance, safety features and available types are perceived as the most important factors to consider. They also found a major percentage deviation between those who are ready to own an electric car and those who are not ready to own an electric car. They concluded by inferring that now is the right time for electric car manufacturers to tap into the market.

The study of Bhalla and Nazeen (2018) outlined the various factors that influence the purchase decision of potential car buyers, finding that individual perception of factors like environmental issues, cost, trust, technology advancement, infrastructure, and society acceptance are all important. The study also found that environmental concerns and consumer

trust on technology were an antecedent factor affecting perception about GTV purchase while the factors that gave the transition a major blow back included cost, infrastructure, and social acceptance. They therefore suggested that in order to promote the sales and use of GTVs, the government has to play a leading role by creating an environmental policy, infrastructure and subsidies of the initial vehicle cost, perhaps by lowering the interest rates on loans charged by the banks. In their study, Ansar and Monika (2019) noted that a majority of their respondents agreed that they are aware that GTVs reduce the emissions and would like to take the initiative. On the other hand, Sharma and Maheshwari (2014) in their study identified the high cost as the highest barrier to purchase GTVs among their respondents. In other words, cost is regarded as the main potential barrier to adopting sustainable practices. The second highest barrier identified by them was lack of understanding and knowledge, which may be attributed to the fact that GTVs are a relatively new option, especially in developing countries. The rest of the factors were related to doubts about efficiency, maintenance, and the dearth of service centres and fuel stations. A study by Mansor, et al. (2014), on the customers' perceptions of the value of green technologies in vehicles in terms of the intangible benefits and costs; their study revealed that customers' intentions to buy green car in Malaysia depended on their perception on environmental benefits, benefit-to-self, attainable cost and comparative cost.

Trends

In developed countries, as documented in United Nations Environment Programme (2012)**,** there has been a rapid switch from coal to natural gas and renewable energy for generating electricity, leading to lower overall CO_2 emissions. However, the reverse has been the case in developing countries where coal production is still expanding, though with a little but increasing share of new energy production coming from renewables. With a green technology approach, efforts to reduce CO_2 emissions could be accelerated, although it must be kept in mind that the share of fossil fuel use is still around 80% **(**Sawin, 2016), and these fuels cannot be rapidly removed from the world's energy menu. But a better balance between fossil fuels and renewables would help the global community to gain some extra time in the effort to limit climate change and its attendant consequences. In order to sell green technology to the world and encourage the transition from the use of fossil fuel to alternative energy technologies, Axsen and Sovacool (2019), pointed out a few salient points to advancing the power of positive green thinking:

- Inventors need to realize that green inventions and clean technologies are good business. They are fast-growing markets with growing profits.
- Consumers need to know that buying green inventions can reduce energy bills and are often safer and healthier than other non-green-counterparts
- Making a small change can have a large long-term impact.

Types of Green Vehicle Technologies

In their submission**,** Environmental Protection Agency (2019), listed the various green technology alternatives for replacing conventional fuels (i.e., gasoline and diesel) as:

FFV: Flexible fuel vehicles (FFVs) can use gasoline or E85 (a mixture of 85% ethanol and 15% gasoline). E85 can be found at over 2,000 stations in the United States.

EV: Electric Vehicles. These can be charged at one of more than seven thousand public charging stations in United States of America. Charging can also be done at home.

PHEV: Plug-in hybrid electric vehicles (PHEVs) are powered with electricity and gasoline. The quantity of gasoline used depends on how often it is plugged in, how far it is driven, and the vehicle's design.

CNG Vehicle: Compressed natural gas (CNG) fuelling station pumps look similar to gasoline pumps but have specialized fittings for a leak-free connection to the natural gas vehicle.

FCV: Fuel cell vehicles (FCVs) use pressurized hydrogen, which is pumped into the car through a special leak-free connection. This hydrogen powers the fuel cell, which in turn generates electricity used to power the vehicle.

According to Sharma and Maheshwari (2014**),** several famous automobile manufacturers, including Toyota, Volkswagen (VW), Honda, Ford, Mahindra & Mahindra, GM, Hindustan Motors and Maruti, are in close competition with each other in producing green cars. Toyota's Prius is the leader of the green car market, with other options being Mitsubishi's i- electric car, Ford's Escape and hybrid vehicles, Honda Civic & Accord cars, Chevrolet's Civic, Nissan's Leaf, Volkswagen's Jetta Hybrids, etc. Reva motors are now powering REVA-India's electric car and the Honda Civic, India's first electric car. Unfortunately, most of these technological advances have been in private mobility vehicles and not in mass transportation. In his study, Singhal (2017) opined that since vehicles contribute over 60% of particulate air pollution and over 20% of the CO2 emissions, green technology vehicles are the necessary way forward to improve air quality. He further stated that green technology will offer transformative solutions that eliminate pollution sector by sector rather than incremental solutions that not only trend back toward the status quo while giving the perception of improvement when the reality points in the opposite direction.

Performances on Transitioning by Some Selected Countries

Currently, both developing and developed countries are making conscious efforts towards the reduction on carbon emissions as Climate scientists have warned that the best tool to tackle rising global temperatures is to reduce GHGs emissions as quickly as possible **(**Mutezo and Mulopo, 2021**).** According to Meredith and Handley (2021**),** the Glasgow Climate Pact reached during the COP26 summit held in 2021 marked the first time ever that an international climate deal explicitly mentioned fossil fuels. The final agreement called for countries to "phase down" the use of and other "inefficient" fossil fuel subsidies.

According to World Wide Fund (2021), policy recommendations on transitioning are the next big steps to achieving a more sustainable climate. The report mentioned some of these recommendations as; the seizure of every exploration for new oil and gas resources; putting a stop to investments towards the development of oil and gas reserves beyond that which had already been sanctioned as at January 2020; the consideration of a shorter life span for oil and gas fields currently under production to make sure the world is aligned with the 1.5°C threshold; no development for new infrastructure for the production, refining, transportation and use of oil and gas (including power plants) that produce emissions exceeding the carbon budget aligned with the 1.5°C threshold; phasing out of existing power stations with the largest climate impact irrespective of the license duration economic life span of the installation; ending oil and gas production by 2040 especially in high- and upper-middle income countries need to, while the low-income countries should end production by 2050.

According to World Economic Forum (2021), the Energy Transition Index (ETI) is used to measure individual countries' progress on transitioning from fossil fuel to alternative energy. The ETI benchmarks countries not only on the performance of their energy system but also on their readiness to transition to a secure, sustainable, affordable, and a reliable energy future. The ETI scores on a scale of 0 to 100. Their 2021 report looked at lessons learnt from the past ten years and summarized that not only did the total ETI score rise, the top three (improvers) countries remained Denmark, Finland and the United Kingdom while countries like China, India and Sub-Saharan African nations with rising energy demand, have their ETIs remain low in absolute terms. Figures 1a & 1b shows the transition index for 115 countries with Nigeria inclusive as a Sub-Saharan African country. The scores for both system performance and the transition readiness automatically place each of the countries to

one of these four strata; Leading countries – with well performing systems and high transition readiness; Leapfrog countries – with below average performing system but high transition readiness; Emerging countries – with below average performing system and below average transition readiness; Countries with potential challenges – with above average performing system but below average transition readiness.

This stratification placed Nigeria and most other Sub-Saharan African countries on the 'emerging countries' list having fallen short of a global average of 59; hence, a need to ascertain the perception, willingness and awareness of the consumers of the transport sector which is principal source of substantial energy consumption and also a contributor of more than 20% GHGs emission as opined by Li and Loo (2014) and Longo, Foiadelli and Yaïci (2018)**.**

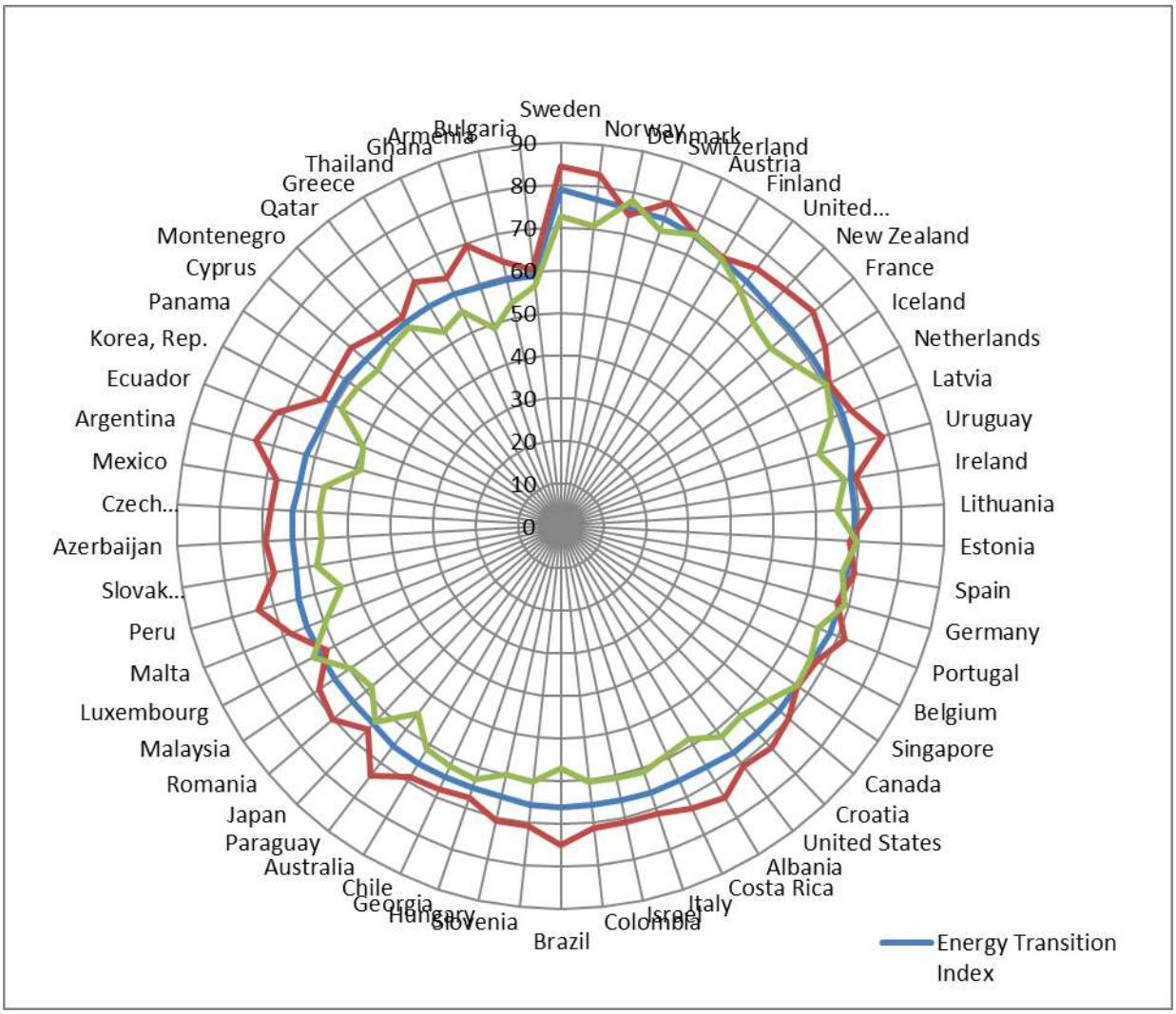

Fig. 1a *ETIs for top 58 of 115 selected countries. Created from WEF (2021) data*

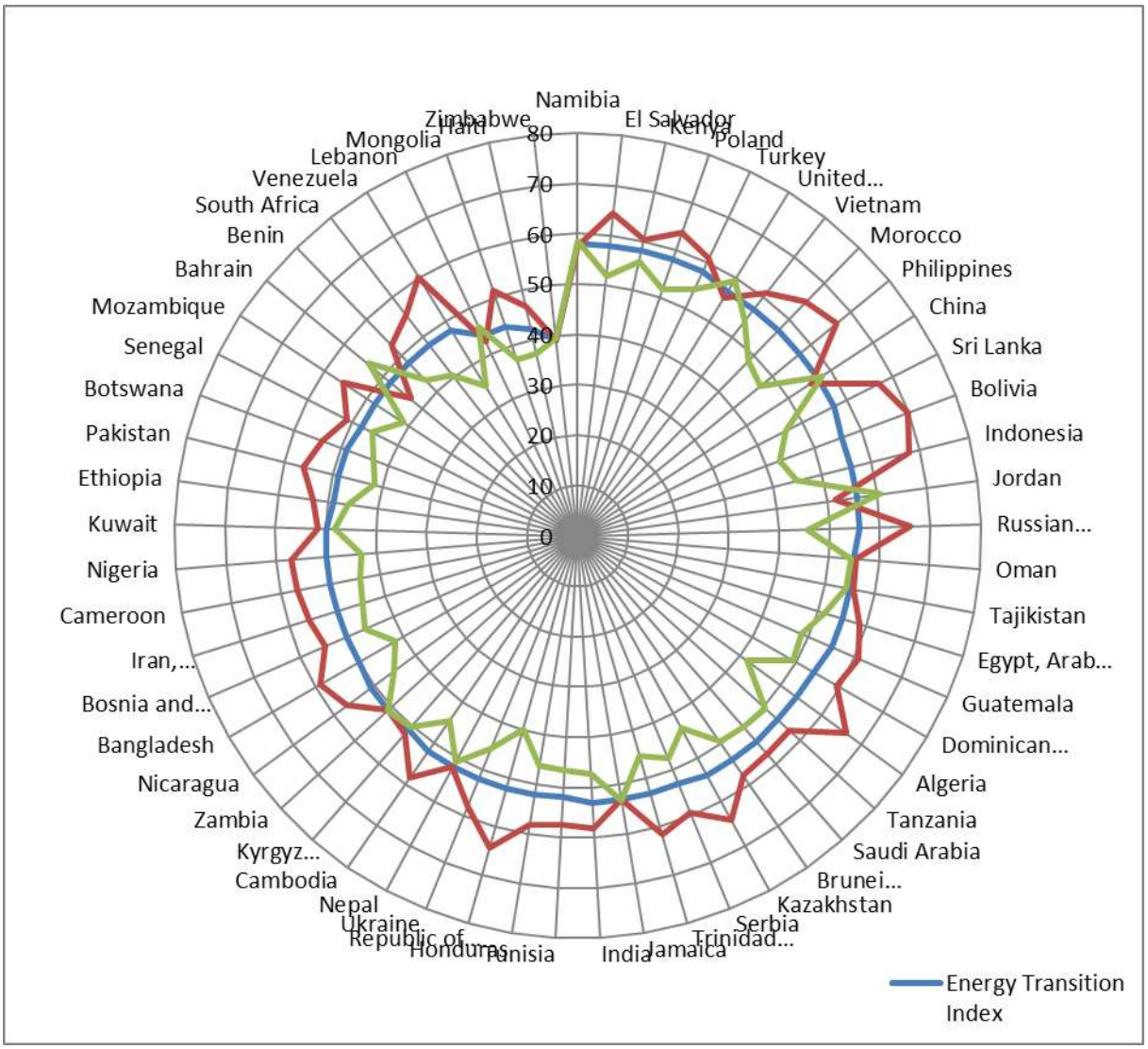

Fig. 1b *ETIs for bottom 57 of 115 selected countries. Created from WEF (2021) data*

The Challenges of GTVs and Transitioning

As much as one of the key challenges in the process of adapting to the impacts of climate change is a transition from a fossil fuel economy to a transportation system based on GTVs, it does not go to say that there are no negatives to the use of GTVs. However, the positives outweigh the negatives. For instance, according to their comparative study between EVs and fossil fuels, Longo, Foiadelli and Yaïci (2018) argued that the increasing demand for electricity generation will make a huge impact on the overall power system in Europe. The potential electricity consumption needed by the proposed 80% share of EVs in 2050 is estimated to differ between 3 and 25% of total electricity demand across Europe. They further argued that future optimization of EVs will be quite focused on technological optimization and market improvement. Technologically speaking, the major challenges are on hinged on the reliability and durability of batteries and super-capacitors, reduction of battery weight and volume, improvement of hybrid electric powertrains, charging infrastructure and plug-in solutions, safety improvement and finally on cost reduction. Despite these various challenges, they concluded that the overall avoided CO_2 emissions in the road transport sector based on fossil fuel should outweigh the higher emissions from electricity generation. According to Li

and Loo (2014)**,** there are still multiple challenges in applying these new technologies even after policies promoting its use seen as the sales of EVs and PHEVs have just started picking up over the past five years. As Gil-García et al. (2021) reported, China leads the EV sales market with 1.11 million EVs sold in 2019, almost doubling the sales of 2017 with more than 50% of world sales, although a recorded 5% decrease compared to 2018. The USA ranks second with 0.33 million EVs sold in 2019; a growth of 52% when compared with 2017 and a decrease of 11% compared to 2018. In 2020 and for the first time, Europe led the ranking with nearly 1.4 million EVs sold displacing China. A whopping 137% increase in growth in sales for 2020 compared to 12% and 4% increase in China and the USA respectively. These strides made in developed countries as fluctuating as it is can be considered "giant strides" when compared with African nations where most vehicle purchased for commercial transport are either second hand or even third hand shipped into the countries. In Africa, Sakah et al. (2017), and Ahove (2014) pointed out that the technical and economic characteristics of African nations are a major challenge for transitioning. They also addressed the need for more renewable energy projects to be implemented successfully by big industry players and not left in the hands of start-ups. According to García-Olivares, Solé and Osychenko (2018)**,** the energy cost of the transition from the current transport system as well as the electrical energy required for the operation of a new 100% renewable transport sector when estimated would demand about 18% less energy and provide the same service as global transport in 2014. This implies that not only is transitioning safe for mother earth, it is indeed feasible.

Research design

The study reported in this paper adopted both qualitative and quantitative research designs involving a descriptive survey and focus group discussions. Use of the descriptive survey was chosen because this approach allows for the determination of vehicle characteristics and driver characteristics through the use of a questionnaire. The focus group discussion approach was chosen because it enabled the researcher to get some particular information that may not emerge from collective sampling.

Study Area

Ikeja city is a large component of the Lagos megacity. Lagos itself is the most populated city in Nigeria, located at 6°34′60″N, 3°19′59″E along the West African coast **(**Ahove, 2014**).** In the general context, the state is made up of twenty local government council areas out of which sixteen forms the megacity of Lagos; the Ikeja Local Government Area (LGA) is one of them. Ikeja is both the administrative capital and headquarters of Ikeja LGA of Lagos state with a land area of 49.92 square kilometres and with an unknown water area (Ahove, 2014). Ikeja LGA as shown in Figure 2 is located in the north-central part sharing boundaries with Agege LGA and Alimosho LGA in the west; Kosofe LGA and Mushin LGA in the east, while Oshodi-Isolo LGA and Onigbongbon Local Community Development Area (LCDA) forms the boundary in the southern part and Ikosi-Isheri LCDA and Ogun State in the north.

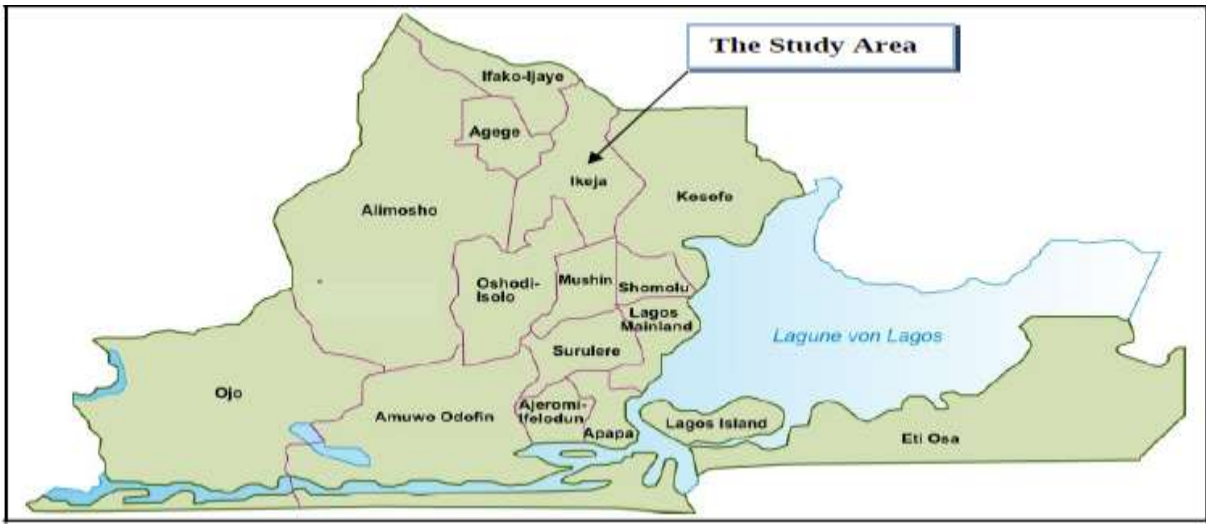

Fig. 2 *Map of the study area.*
Source: (Longo, Foiadelli, and Yaïci, 2018)

Population for the Study

The study population was comprised of commercial road passenger vehicles that ply selected routes in the Ikeja area of Lagos state. This does limit the response to only drivers of the vehicles that ply within the selected areas will have the questionnaire administered to them. Also, only commercial passenger vehicles that are duly registered by the state government for commercial activities on the selected routes were studied. In the context of this study, commercial vehicles refer to commercial road passenger transport, which includes all motorized vehicles that are licensed to travel for commercial purposes of conveying only passengers.

Sample and Sampling Techniques

A blend of two sampling techniques was used in this study. First was the quota sampling technique Tyrer and Heyman (2016), as a non-probability equivalent of stratified sampling where the researcher first identifies the strata and their frequency in the population and then uses convenience sampling to select the required number of participants from each stratum. The population was first divided into 5 sub-groups (quotas) which fully represented the various vehicle categories. They included: Keke (Tricycle), Shuttle (mini-bus) and Danfo bus (14, 18 and 22-seaters). Convenience sampling was then used to select the 15% of the quota population that was obtained from Transport union unit statistics to form each quota sample size. Only vehicles duly registered with the MVAA and RTEAN or NURTW at some stage during the survey period were selected. Secondly, a purposive sampling technique was employed for the focus group discussion as it is the most appropriate way to engage the audience given that random sampling was possible because of the volatile nature of the sample **(**Warner, Lamm and Rumble, 2018**).**

Research Instrument (Questionnaire)

The instrument had three parts:

Part A: Background/Driver Information: This section covered items regarding the socio-demographic characteristics of the respondents.

Part B: Vehicle Characteristics: This section elicited information on the vehicle technology, irrespective of usage, with variables like vehicle type, number of engine plugs, type of fuel used, and other similar information.

Part C: Focus Group Discussion (FGD)-a total of fourteen questions was structured to provide the answers to each driver's level of awareness and perception of green technology vehicles. The questions also elicited information on possible factors that might motivate them to make the transition from fossil fuel use to GTVs.

Data analysis

Descriptive analysis was used to analyse the frequency distribution of variables in terms of the number of responses for each variable as a percentage of the entire responses **(**Kothari and Gaurav, 2014**).** Also, weighted average score (WAS), which is basically an average consisting of lesser or greater weight given to some figures in a data set Taylor (2017)**,** was used.

A total of 14 statements were used to ascertain how the drivers perceived GTVs. Responses to the statements were ranked on a 4-point Likert Scale ranging from SA to SD. In coding the Likert, the values for SA, A, DS and SD were graded 4, 3, 2 and 1, respectively. The generated data were subjected to a weighted average score (WAS) analysis. The threshold value to ascertain the degree of agreement (motivating factor) was determined by adding up the grades and dividing the sum by the number of ranks possessed by the Likert scale which is 10/4. We thus have: (4+3+2+1)/4 =2.5. This implies that any statement with a WAS of less than 2.5 indicates a lower degree of agreement while any statement with WAS equal or above 2.5 indicates a higher degree of agreement.

3 RESULTS AND DISCUSSION

Figures 3 & 4 show the percentage distribution of respondents' awareness of green technology while Figure 5 shows the perception.

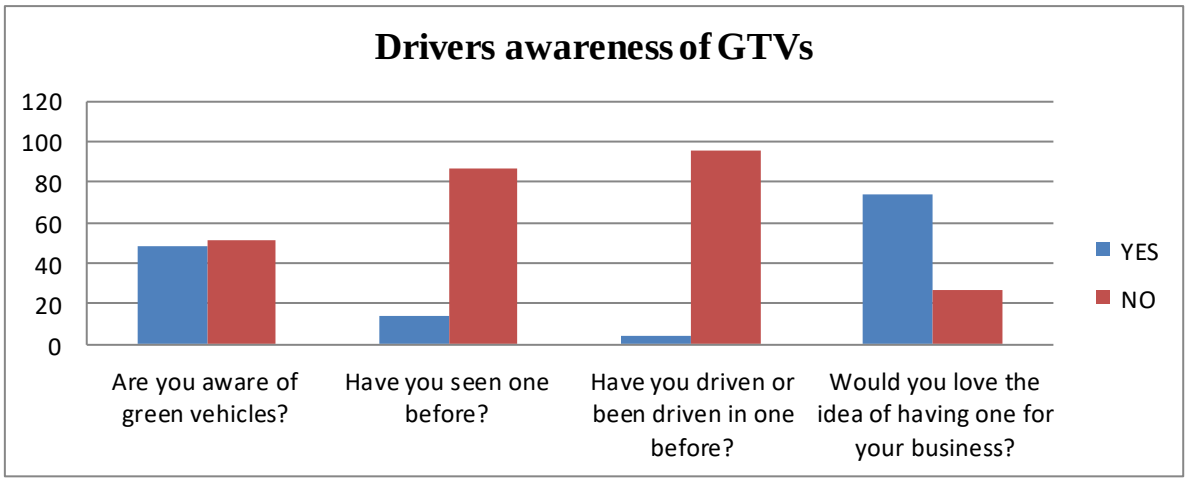

Fig. 3 *Percentage distribution of respondents' awareness of green technology vehicles*
Source: Authors' field work

48.7% reported as being aware of GTVs. 39.6% correctly mentioned sources of power used in place of petrol and diesel while 55.9% had no idea of what might be used in place of petrol and diesel. The majority of the respondents have not seen (86.6%) or driven/been driven (95.6%) a GTV. The majority of the respondents (73.7%), however, responded positively to the idea of using a GTV for their business. Most of the respondents (93.2%) agreed that GTVs are the best way to reduce carbon in the environment; most of them (75.4%) also agreed that GTVs are not easily available and therefore they are not interested;

76.6% of the respondents agreed that commercial vehicles do not use GTVs because of the initial cost of purchase; 74.2% agreed that commercial companies do not use GTVs because they are not cheap to maintain; 69.9% agreed that commercial vehicles do not use GTVs because they are not suitable for commercial transport; 74.5% agreed that commercial vehicles do not use GTVs because the fuel/service stations are not available; 68.9% agreed that GTV is not a good idea because it is purely meant for rich private cars; 80% agreed that many drivers are not using GTV because the government has not facilitated the transition; while 89.3% would love to use GTV because it protects the environment.

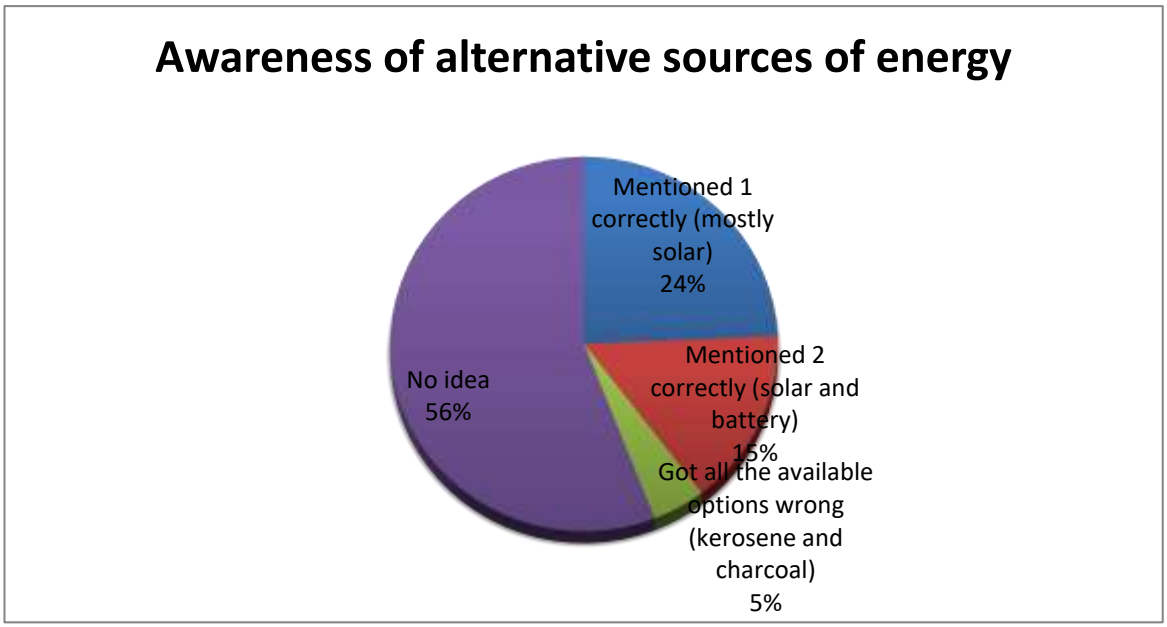

Fig. 4 *Percentage distribution of respondents' awareness of alternative sources of energy*
Source: Authors' field work

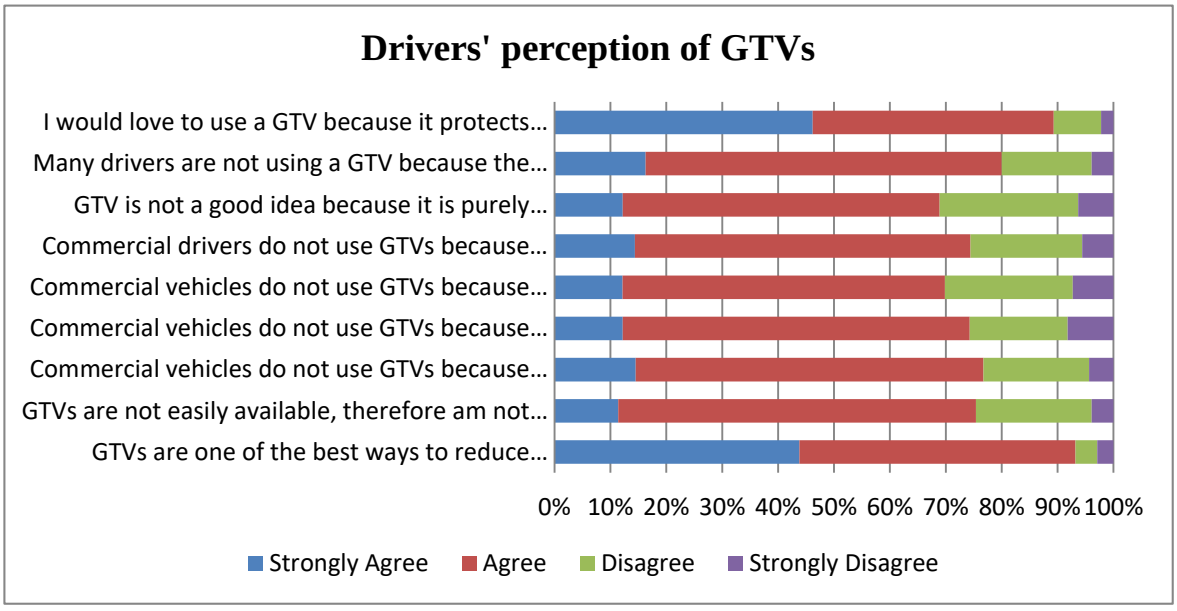

Fig. 5 *Percentage distribution of respondents' perception on green technology*
Source: Authors' field work

To achieve the objective of this study, which was to assess the perception of drivers towards using green technology as a measure of climate change mitigation. With this in mind, the questions probed knowledge of the existence green technology vehicles and also the factors that could motivate drivers to transition to using GTVs. Knowledge of the existence of GTVs would be expected to play a role in their perception and also to play a role in their decision making. The results show that the majority of the respondents were not aware of much about GTVs. Of the ones that were aware, 24.3% correctly mentioned only one type of GTV, whether powered via battery, solar or compressed natural gas, as vehicles currently used in place of petrol and diesel vehicles; and only 15.3% correctly mentioned two types of GTVs. The results also indicated that their awareness came mainly from what they heard and what they saw on television and rather than coming in physical contact with a GTV, with only 4.4% of the respondents reporting to have either driven or been driven in one. In line with the objective of the study, the respondents were asked about whether they would like to have a GTV for their business. In response to this question, a whooping majority (73.7%) responded in the affirmative, while the remaining 26.2% indicated no interest.

Tab. 1 *Results of weighted average score (WAS) analysis on the perception of drivers regarding use of green technology vehicles for climate change mitigation*

Variables of perception towards using green technology vehicles for Climate Change mitigation.	**Strongly Agree (4)**	**Agree (3)**	**Disagree (2)**	**Strongly Disagree (1)**	**Weighted Average Score (WAS)**
GTVs are the best way to reduce carbon in the environment	180	203	16	12	3.34
GTVs are not easily available and therefore I am not interested in them	47	263	85	16	2.83
Commercial drivers do not use GTVs because of the high initial cost of purchase	60	255	78	18	2.87
Commercial vehicles do not use GTVs because they are not cheap to maintain	50	255	72	34	2.78
Commercial vehicles do not use GTVs because they are not suitable for commercial transport	50	237	94	30	2.75
Commercial vehicles do not use GTVs because fuel/service stations are not available	59	247	82	23	2.83
GTVs are not a good idea because they are purely meant for rich private cars	50	233	102	26	2.75
Many drivers are not using GTVs because the government has not facilitated the transition	67	262	66	16	2.92
I would love to use a GTV because it protects the environment	190	177	35	9	3.33

Peoples' perceptions about a particular subject are most often born out of underlying reasons and knowledge. These reasons could be based on the make-up of the subject or just hearsay. According to the new international English Dictionary, perception is concerned with discernment or judgment; insight gained from the observation of a particular subject. Weighted Average Score (WAS) analysis was used to examine 9 statements relating to the degree of agreement of the drivers' views on green technology vehicles. The WAS of 2.5 and above for each variable indicates a higher degree of agreement while a WAS below 2.5 indicates a lower degree of agreement. The results as shown in Table 1 below indicate that all the variables recorded a WAS of 2.5 and above, but with two aspects showing exceptionally high agreement, namely: GTVs are the best option for reducing carbon from the environment (3.34) and interest in using GTVs is present mainly because it protects the environment (3.33). These two variables were basically the only variables that reflected understanding regarding the impact of carbon on the environment as a factor while the rest of the variables reflect the economic and social factors that can motivate the drivers to make a transition.

When questions on readiness to use a GTV if provided with one were raised during the focus group discussion, a remark by one of the drivers interviewed seemed to sum up the general view:

"***I have been fortunate enough to drive a GTV (CNG) that was provided by an uncle living abroad and I can tell you that I did not enjoy the experience at all. I was faced with the challenges of fuelling it and after some time I had to do a reconstruction that enabled me to use the vehicle with fossil fuel. I do not think that we are ready to make the change yet, so I will choose my normal vehicle any day any time***"

Another factor that was highly mentioned was the possibility of the government making this transition first as drivers of commercial vehicles can barely afford to buy a second-hand vehicle for their business, not to mention a GTV. To this effect, one of the respondents stated that:

"***Most of these GTVs are seen in developed countries because their government can afford to give it to the drivers at a very subsidized rate. But here in Nigeria, only rich private cars can use this. Although it pays (i.e., is more economical) at the end of the day, but to start is a big problem***"

Having established the factors that can motivate the drivers to make a switch, it appears that the drivers are willing to make this transition if factors like availability of GTVs, fueling/servicing and maintenance stations, subsidized initial cost of purchase and proper enlightenment are dealt with.

4 CONCLUSION

At the moment, the use of alternative fuels in urban transportation is becoming increasingly popular in developed and developing countries; however, their applications are still limited because the technologies are immature, expensive, and unrecognized by the major consumers. The perception of drivers towards green technology vehicles has been found to be more on the environmentally favourable side. They believed that with the right arrangements in place (like fuel and service stations for GTVs, and a subsidized initial purchase cost) they would be able to make a smooth transition to the use of green technology vehicles in order to help save the environment. Sustainable approaches are recognized as the answer for most environmental problems and GTVs are a step toward sustainable development. It is recognized that if people pay a high initial cost for GTVs, the ongoing maintenance and running costs are comparatively low, making GTVs more economical over

the life of the vehicle. This fact should be publicized widely through appropriate media to encourage the drivers. Drivers also believe that, at the moment, the government should take bold steps to promoting growth in the use of green technology vehicles in the state transportation system and gradually encourage private investors to do likewise. Green technology is a new concept that should be introduced and explained to all parties involved. Green technology can be seen as the technological approach that will transform the fossil fuel era into the renewable era, thus promoting a cleaner, more sustainable and friendly environment. Albert Einstein's famous quote provides clear advice: "This world will not evolve past its current state of crisis by using the same thinking that created the situation". The mobility industry could be rejuvenated by embracing renewable materials and green options. One possible follow-up measure would be to establish a task-force team of interested stakeholders to outline the role of technology management in promoting, accelerating and facilitating the implementation of these options. Road transport operators want to do the right thing when it comes to protecting the environment and maximizing their resources, but it must be affordable. With the green movement gathering momentum, this may be the best time to encourage and help them to make the desired changes by supporting the transition with subsidies.

Recommendations

- Technological changes and improvement in the transportation sector will need to be spearheaded by the Government because of the high initial cost of purchasing GTVs. Service/maintenance stations also need to be made available in addition to upgrading of fuelling stations to accommodate the sale of green fuels and access to charging stations.
- The building of the light rail system proposed by the Lagos State government will also promote progress toward sustainability. Light rail transportation technology is unique and faster in getting the people to their destinations. This would be expected to help reduce the use of vehicles plying the roads and therefore reduce fossil fuel consumption and vehicular emissions.

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