FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

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By

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INAUGURAL LECTURE SERIES 65

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PREAMBLE

An inaugural lecture is glorifying as a man or woman getting married and it comes with some trauma as a woman in the labour room who after delivery forget the agony. I am glad today because it is my turn to give the fourth series in the Department of Urban and Regional Planning and being the sixth in the School of Environmental Technology.

Mr. Vice-Chancellor, sir.

As a professor of Urban and Regional Planning (URP) whose research orientation and perspectives have widened to include areas of interest such as Environmental Impact Assessment, Remote Sensing Applications, Transportation Planning and Management, my major area of emphasis is on the application of technology to transportation and this has INFORMED the choice of my topic for today's Inaugural Lecture titled: ***Leveraging Advances in Transport Development: To Where is Nigeria Heading?*** This invariably reflect the multidimensional nature of urban and regional planning as a discipline concerned with providing answers to *What, Where, Why, How and the Impacts* of the built environment, but also gives discourse on man's most fundamental needs of overcoming the friction of space since their needs are not always in *situ*.

I will like to quickly establish the fact that there are many areas of specialization in transportation generally without conflicting interest and areas of focus, which include:

Transport Geography which is a sub-discipline of Geography that seeks to understand the spatial organization of mobility by considering its attributes and constraints as they relate to the origin, destination, extent, nature and purpose of movements. It investigates the movement and connections between people, goods and information on the earth's surface.

While **Transport Engineering** is one of the essential civil engineering disciplines, impacting roadways, bridges, transit stations, airports and sea ports etc. It focuses on the structural design and implementation of large public and private infrastructure systems that connect our physical world; while applying technology and scientific principles to the planning, functional design, operation and management of facilities for any mode of transportation in order to provide for the safe, efficient, rapid, comfortable, convenient, and economical.

Transport planning on the other hand involves developing model and techniques for: forecasting origin and destination of trips, modal choice, trip distribution, future travel demand and determining supply and improvements to the transport infrastructure thereby reducing energy use. It also uses planning methods to predict, represent and quantify: the evolution of land use in cities, travel attributes such as trip purpose, travel decisions, including modal split. Planning models then examine the feasibility of projects and policies through cost-benefit and scenario analysis.

Transport Economics is a branch of economics founded in 1959 by American economist John R. Meyer that deals with the **allocation of resources** within the transport sector. It has strong links to civil engineering and it differs from other branches of economics in that the assumption of a space-less, instantaneous economy does not hold. It is assumed that demands peak advance ticket purchase is often induced by lower fares and that the networks themselves may or may not be competitive. A single trip (the final good, in the consumer's eyes) may require the bundling of services provided by several firms, agencies and modes.

On the other hand, Transport Management (Technology and Studies) is concerned with the optimization of the utilities of all the transport modes thereby making right product and services available at the right time, right price and at right place while leveraging on IT technological advancement for Real time transportation tracking. It is concerned with routing and scheduling which is most fundamental in supply chain or logistic management as it address all costs associated with inbound and outbound transportation modes.

Membrane Transport is a bit isolated from the rest so far discussed but is more related to liquid conveyance from one location to the other in human system as human body is about 60-70% water (99% water, 0.83% ions and 0.17% organics). Passive-mediated transport facilitated diffusion (High to Low concentration), while active transport: from Low to High concentration may require energy or membrane potential.

1. History of Transport

Transportation is as old as man on the planet earth as man moves from one point to another in search of basic necessities of life. From human porterage to the use of donkey and horses for the conveyance of goods around 3500 BC Later on wheel was invented. The industrial revolution actually revolutionize the transport sector at the end of 18^{th} century Transport innovation has bridged locations that previously seemed impossible and the increase in speed has enhanced quicker interaction along development corridors within and between the main urban centres or peripheries. It is generally agreed among scholars that transportation occupies a crucial place in the process of economic development (Olukoju, 1996).

Transport development in Nigeria has impacted greatly on the socio-economic growth of the nation as it over depend on road transport system. The demand for transportation facilities is a derived demand as a means to an end According to Anyanwu et al (1992) the history of road transport in Nigeria can be traced back to 1904 when Lord Luggard attempted the construction of a mule road linking Zaria and Zungeru both in the Northern parts of Nigeria. The same road was later extended from Zaria to Sokoto, Katsina and Maiduguri, although, the road linking Ibadan and Oyo constructed in 1906 is recorded to be the first motorable road ever constructed in Nigeria. Of all freight movements to and from the sea-ports, two-third are now been conveyed by road, while up to 90% of all other internal movements of goods and services take place by roads.

Automobiles have made great contributions to the growth of modern society by satisfying many of its needs for mobility in everyday life. The rapid development of the automotive industry, unlike that of any other industry, has prompted the progress of human society from a primitive one to a highly developed industrial society. The inimitable goal of transportation is to overcome space, which is a function of a variety of human and physical constraints such as distance, time, political system and topography. Collectively, they attract a friction to any movement, generally known as the friction of space which can always be partially circumscribed as in Fig. 1.

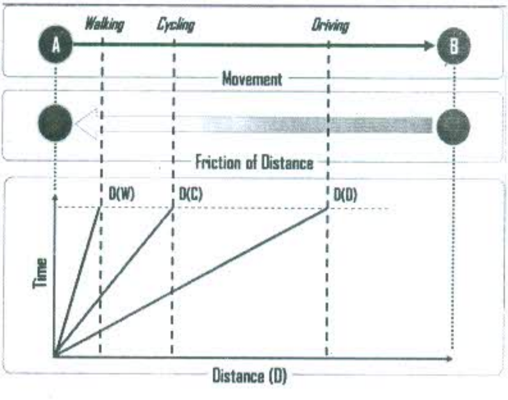


Figure 1. Transport mode and friction of space.

2. Evolution of automobile industry

In carrying out an evolutionary review of automobile design and development, Ferdinand Verbiest, a member of a Jesuit mission in China will readily come to mind. He was the first to build a steam-powered vehicle around 1672 as a toy for the Chinese Emperor. In 1806, the first cars powered by an internal combustion engine running on fuel gas appeared, which led to the introduction in 1885 of the ubiquitous modern gasoline - or petrol-fueled internal combustion engine. However, the year 1886 is regarded 'the year of birth of the modern automobile' – with the Benz Patent - Motorwagen, by German inventor Carl Benz, (Eckermann, Erik (2001).

In terms of early gaseous experimented, the Swiss engineer François Isaac de Rivaz built an engine powered by internal combustion of a hydrogen and oxygen mixture in 1806. While in 1826, an Englishman Samuel Brown tested his own hydrogen-fuelled internal combustion engine by using it to propel a vehicle up Shooter's Hill in south-east London. Another Belgian-born Etienne Lenoir's Hippomobilemade a test drive of his hydrogen-gas-fuelled one-cylinder internal combustion engine from Paris to Joinville-le-Pont in 1860, covering some nine kilometers in about three hours, (Eckermann, Erik (2001).

Nicolas-Joseph Cugnot also later built steam-powered self-propelled vehicles large enough to transport people and cargo in the late 18th century. He demonstrated his *fardier à vapeur* ("steam dray"), an experimental steam-driven artillery tractor, in 1770 and 1771. But as technological innovation shifted to Great Britain, *William Murdoch* in 1784 built a working model of a steam carriage in Redruth, and in 1801 Richard Trevithick was running a full-sized vehicle on the road sin Camborne, (Eckermann, Erik (2001).

In 1815, *Josef Bozek*a professor at Prague Polytechnic built an oilfired steam car. While in 1867, Canadian Jeweler Henry Seth Taylor demonstrated his 4-wheeled "steam buggy" in Quebec. But what can be defined as the first "real" automobile was produced by *Amédée Bollée* in 1873; it was self-propelled steam road vehicles to transport groups of passengers. The four-stroke (gasoline) internal combustion engine that constitutes the most prevalent form of modern automotive propulsion is the work of *Nikolaus Otto and Rudolf Diesel*. Steam-powered automobiles continued to develop up till the early 19th century before the petrol engines as the motive power of choice in the late 19th century. The first motor car in Central Europe was produced by Czech company Nesselsdorfer Wagenbau (later renamed Tatra) in 1897, (Eckermann, Erik (2001).

In Vienna Austria, another inventor called Siegfried Marcus put a liquid-fuelled internal combustion engine on a simple handcart which made him the first man to propel a vehicle by means of gasoline in 1870. This car is known as "the first Marcus car". In 1883, and the design was used for all further engines, and the four-seat "second Marcus car" of 1888/89. This ignition, in conjunction with the "rotating-brush carburetor", made the second car's design very innovative. Figure 2 reveals the chronological transformation in shape and functionally of the automobile to the present modern era SUV models, (Eckermann, Erik (2001).

The electric ignition system can be linked to *Robert Bosch* in 1903, but independent suspension was actually conceived by Bollée in 1873 and four-wheel brakes by the Arrol-Johnston Company of Scotland in 1909. Since the first Ford's Model Ts vehicle in 1908 which has metamorphosis into the present day hybrid vehicles, the technological revolution in the manufacturing of automobiles requires an equally rapid advancement in human capacity development to attend to the associated complex modern era automobile buses.

2.1 Modern Era Vehicles

There are some technical design aspects that differentiate modern cars from antiques. The modern cars have been growing in standardization, platform sharing, and computer-aided design. Some particular contemporary developments are the proliferation of front and all-wheel drive as against back axle, the ubiquity of fuel injection and car brain-box system. Nearly all modern passenger cars are front-wheel-drive designs, with transversely mounted engines, but this design was considered radical as late as the 1970s.

Body shapes and lighting system have changed over the years. These include: the hatchback, sedan, and sport utility series dominate today's automobile market. Old emphasis practicality has mutated into today's high-powered luxury crossover SUV, sports wagon, two-volume Large MPV. The rise of SUVs worldwide has changed the face of motoring, coming to command more than half of the world automobile market, see Fig. 2 for the automobile metamorphosis trend. The modern era has also seen rapidly rising fuel efficiency and engine output with the computerized engine management systems. Thus, necessitating the need for the advancement of automobile mechanics and other automobile technician related entrepreneurs in Africa to keep abreast global best practices in their field, if Africans will continue to maximize the benefits inherent in the modern automobile technology.

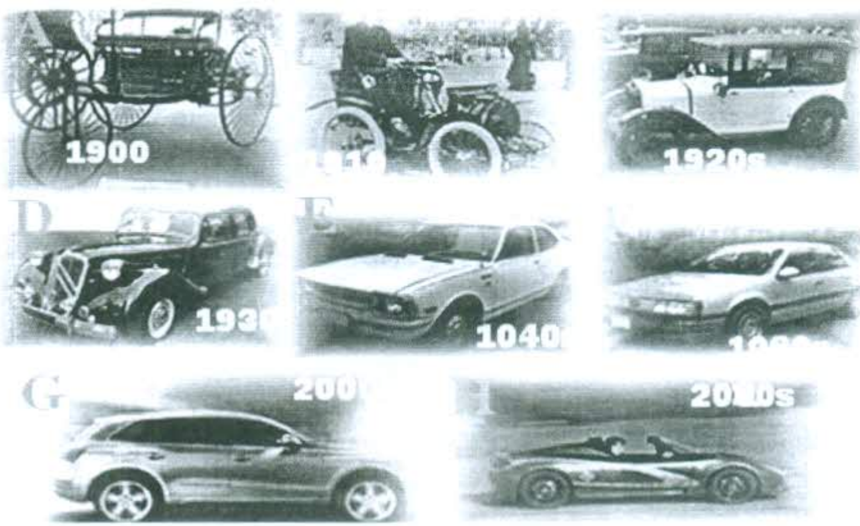


Figure 2. Trend in the automobiles metamorphosis

3. Environmental effect of the Automobile and Energy Shortage

The global acceptation of automobiles as the common mode of transportation by land and the diversification of models has led to the large number of automobiles in use around the world which has triggered and continued to cause serious environmental problems on human life (Ronney, 2017). Air pollution, global warming, and the rapid depletion of the Earth's petroleum resources are now problems of paramount concern. The combustion of hydrocarbon fuel in automobile engines has never been environmental friendly but tolerated as technological advancement, (Dukiya 2013). Besides carbon dioxide and water, the combustion products contain a certain amount of nitrogen oxides (NOx), carbon monoxides (CO), and unburned hydrocarbons (HC), all of which are toxic to human health.

Researches all over the world reveal that the major sources of GHGs as at 2006 were passenger cars (34%) and light duty trucks, which include Sport Utility Vehicles (SUV), pickup trucks, and minivans (28%). Together with motorcycles, these light-duty vehicles made up about 63% of transportation GHG emissions. The next largest sources were freight trucks (20%) and commercial aircraft (7%), along with other non-road sources (which combined, totaled about 7%) (US DoT, 2014, 2015). These, as displayed in Fig. 3, include direct emissions from fossil fuel combustion, from the year 2000; the carbon dioxide emission from the transport sector exceeded that of industries due to the global increase in the rate of car ownership. In response to GHGs challenges, global crusade on climate change and the need for smart city is on the increase. Intelligent Transport System (ITS) as one of the responses to city traffic gridlock, energy crises and climate change refers to the application of communications and information technology to transport infrastructure and vehicles to improve the efficiency of transportation networks (John, 2001).

For instance, the need to improve the balance between different transport modes, and to improve safety and mitigate the impact of transport on the environment are some of the key challenges set out in the European Commission's White Paper on Transport "European Transport Policy for 2010: Time to decide" (CEC 2006, NRC 2001).

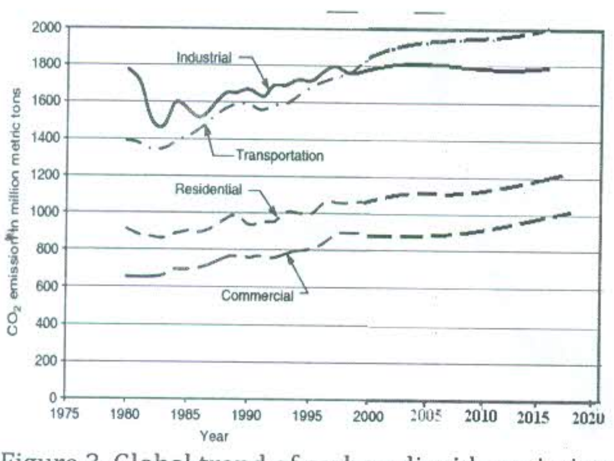
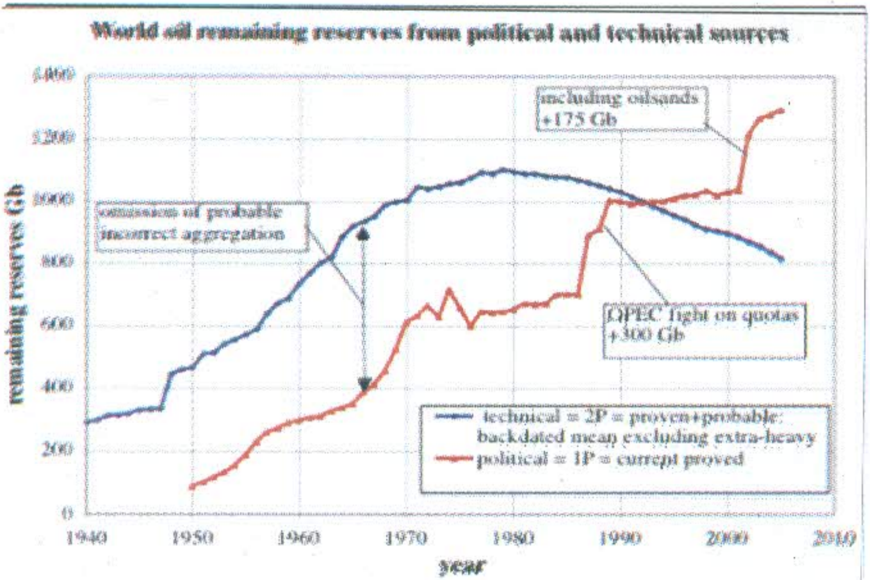


Figure 3. Global trend of carbon dioxide emission

Political data on petroleum reservation is always rising from 1950 till now, when from the technical sources, oil reserves have peaked in 1980. It is well recognized by almost every International Oil Companies (IOC) that, since 1980, oil discovery is less than oil production as indicated in Fig. 4 at the Conference of the Parties (COP) meeting in Paris in December 2015. This is a clear signal that energy leaders believe that the world is in an irrevocable path towards decarburization, one that is no longer entirely dependent on a global climate agreement.

The number of years that the oil resources of the Earth can support global oil supply completely depends on the discovery of new oil reserves and cumulative oil production (as well as cumulative oil consumption). Referenced data show that the new discovery of oil reserves occurs drawlingly; while on the other hand, the consumption rate is skyrocketed due to the rate of car ownership, as shown in Fig. 4a, b. If oil discovery and consumption follow current trends, the world oil resource will be used up by the year 2038, (Ehsani et al 2003). It is becoming very obvious that new discovery of petroleum reserves under the Earth is waning. The cost of exploring new oil fields is becoming higher and higher. It is believed that the scenario of the oil supply will not change much if the consumption rate cannot be significantly reduced. As revealed in Fig. 3, the transportation sector is the primary consumer of petroleum, consuming 49% of the oil used in the world. In the U.S. Energy Information Administration (2016) reference case, transportation sector delivered energy consumption increases at an annual average rate of 1.4%, from 104 quadrillion British thermal units (Btu) in 2012 to 155 quadrillion Btu in 2040. Transportation energy demand growth occurs almost entirely in regions outside of the Organization for Economic Cooperation and Development (non-OECD).



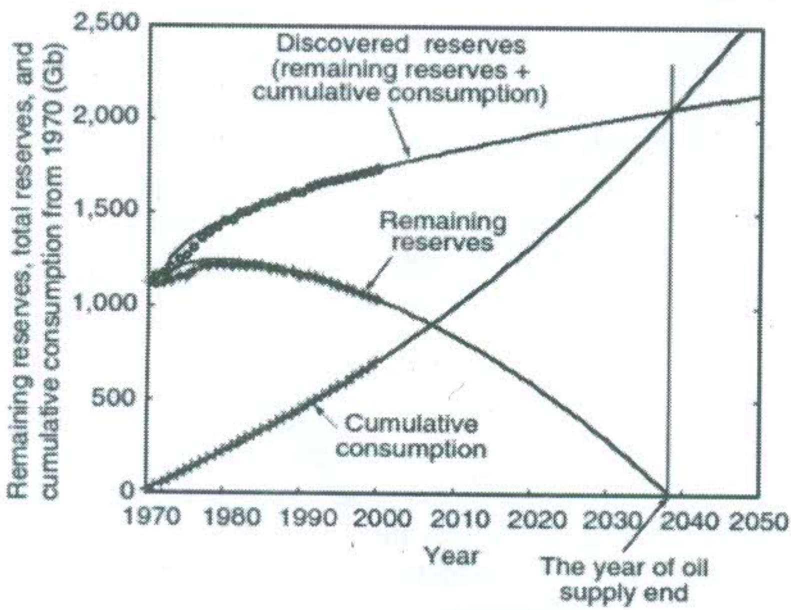


Figure 4: Petroleum deposit and Global consumption trend
Source: After Jean, 2006

In developing countries like Nigeria, the transportation sector shows the fastest growth in petroleum consumption; and unlike in industrialized countries, oil use for purposes other than transportation is projected to contribute 42% of the total increase in petroleum consumption, U.S. Energy Information Administration (2016).

4. Automobiles Conventional Fuel Paradigm Shift

The new knowledge in climate change as at now is the greater certainty that the rate of change is likely to be greater than at any time in modern history [IPCC 2007ab]; and that climate change will not necessarily occur gradually. Climate scientists expect that higher temperatures will be amplified by normal variability in climate, leading to new extremes far outside current experience [e.g., the heat wave in Europe in 2003 (Stott et al. 2004) and the near record heat of 2006 in the United States (Hoerling et al. 2007)]. Higher temperatures are also likely to trigger surprises, such as more rapid than expected melting of Arctic sea ice and rising sea levels, (the New Orleans flood and tsunamis).

Researches reveal that light-duty vehicles generate one-third of global CO2 emissions which is about a third of U.S emissions. Individual vehicles' CO2 emissions capturing is meritoriously impossible, so reductions in the transportation sector can be effected majorly by the replacement of current fuels with lower-carbon or zero-carbon fuels. For instance, in response to a congressional request in the Energy Policy Act of 2005 of USA, the National Research Council (NRC)study estimated the maximum practicable number of hydrogen fuel cell vehicles (HFCVs) that could be deployed in the United States by 2020 and beyond, together with the investments, time, and government actions needed to carry out this transition, (NRC, 2008).

The global awareness of the fossil fuel combustion contribution to GHGs has brought about the discovery of alternative fuels, known as non-conventional or advanced fuels, which are any materials or substances that can be used as fuels, other than conventional fuels. Conventional fuels include: fossil fuels (petroleum (oil), coal, propane, and natural gas, as well as nuclear materials such as uranium. Some well knew alternative fuels include biodiesel, bioalcohol (methanol, ethanol, butanol), chemically stored electricity (batteries and fuel cells), hydrogen, non-fossil methane, non-fossil natural gas, vegetable oil, and other biomass sources.

Staggeringly, the concept of a hybrid electric vehicle is almost as old as the automobile itself. The first electric vehicle was built by Frenchman Gustave Trouvé in 1881. It was a tricycle powered by a 0.1 hp DC motor fed by lead–acid batteries, (Jessica 2017). The modern electric vehicle era culminated during the 1980s and early 1990s with the release of a few realistic vehicles by firms such as GM with the EV1 and PSA with the 106 Electric. The Africa Section of the Society for Conservation Biology (Osondu, 2007, SCB-(IEA, 2004, Biofuelwatch, 2007) distinguishes the various terms often misused in the discussion of alternative fuel as follows:

a. A biofuel is any solid, liquid or gaseous fuel produced directly or indirectly from biomass, such as straw, grass, or processes such as collection of land-fill gas,
b. Agrofuels as products of agriculture biomass, by-products of farming, and/or industrial processing of agriculture-linked raw material. The term covers mainly biomass materials derived directly from crops and agricultural, agro industrial and animal by-products such as dung, corn and soy,
c. While Wood fuels include all types of bio fuels derived directly and indirectly from trees and shrubs which grow

on forest and non-forest lands, including charcoal and methanol, (FAO, 2004, 2008).

The U.S. bio fuel industry has grown dramatically in recent years, with production expanding from 1.6 billion gallons in 2000 to 9 billion gallons in 2008, According to the U.S. EPA's EMTS data for 2017, the U.S. market for biodiesel and renewable diesel topped 2.6 billion gallons. In 2016, the U.S. market approached 2.9 billion gallons. This dramatic increase can be attributed to the rise in production of corn-based ethanol and associated, smaller quantities of soy-based biodiesel. The number of refineries has also increased-from 54 in 2,000 to over 350 in January 2015, (Doug Tiffany, 2018). See Fig. 5a, b for a typical bio fuel filling station.

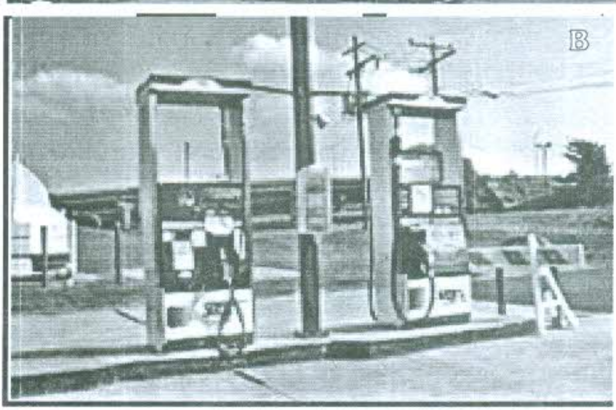


Figure 5: a, b. Typical Brazilian filling station with four alternative fuels for sale: biodiesel (B3), gasohol (E25), neat ethanol (E100), and compressed natural gas (CNG). São Paulo, Brazil. b) Alternative fuel, B20 biodiesel at the left and E85 ethanol at the right Virginia.

Source: www.alamy.com

4.1 Hybrid Urban Mass Transit Buses

Hybrid buses were developed to improve emissions, as well as decrease fuel usage and improve reliability that will translate into significant cost-per-kilometre operating savings. Hybrids are found to be 50 percent quieter than diesels. Hybrid diesel-electric buses (*model DE60LFR*) for instance enabling the Chicago Transport Authority (CTA) to achieve the best performance and safety out of its buses by providing the right information, to the right people at the right time which help transit authorities with the ability to monitor and improve fuel economy, schedule preventative maintenance and ensure that the vehicle operates safely, Philippe (2013).

The hybrid hydrogen bus (fuel cells powered by hydrogen) developed by ATP and Vossloh Kiepe is an innovative approach to tomorrow's local public transport. The emission from the exhaust pipe is said to be simply steam and nothing more. The bus is one of a series of test vehicles for regular service in Amsterdam and Cologne. The new 7900 Hybrid Articulated model that takes productivity to new levels, offers fuel savings of up to 30%, high capacity of up to 154 passengers, over 50% more passenger capacity and 15% lower fuel consumption per passenger compared to a 2-axle Volvo hybrid bus, see Fig. 6 and 7 for the comparative efficiency and global trend of usage, Siemens AG (2016).

Plug-in hybrids enable silent operation in the centre and in sensitive areas. The introduction of charging stations enables 75% electric drive with the reliability of diesel power. Electric buses are introduced in dense city traffic. Plug-in stays efficient outside the centre and in intercity operation. Hybrid buses are preferred in transit operation and where the frequency does not motivate charging station investments.

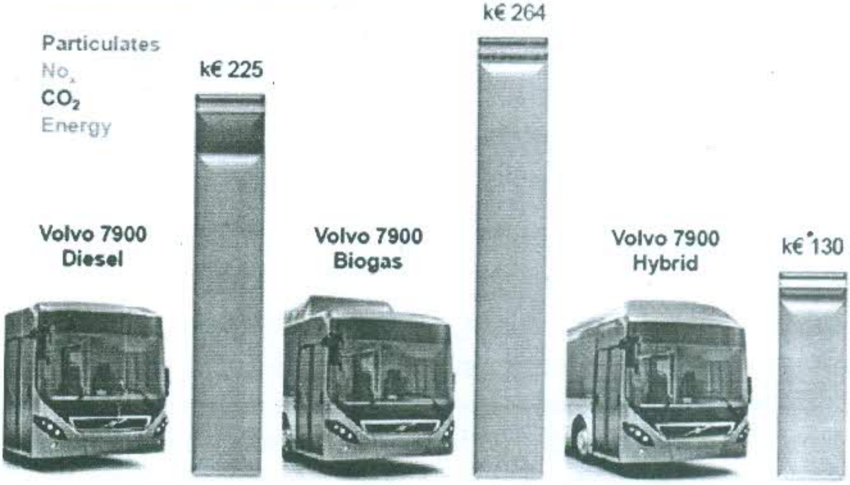


Figure 6: Comparison of high capacity buses in relation to environmental friendliness and energy consumption.

Source: Siemens AG 2016

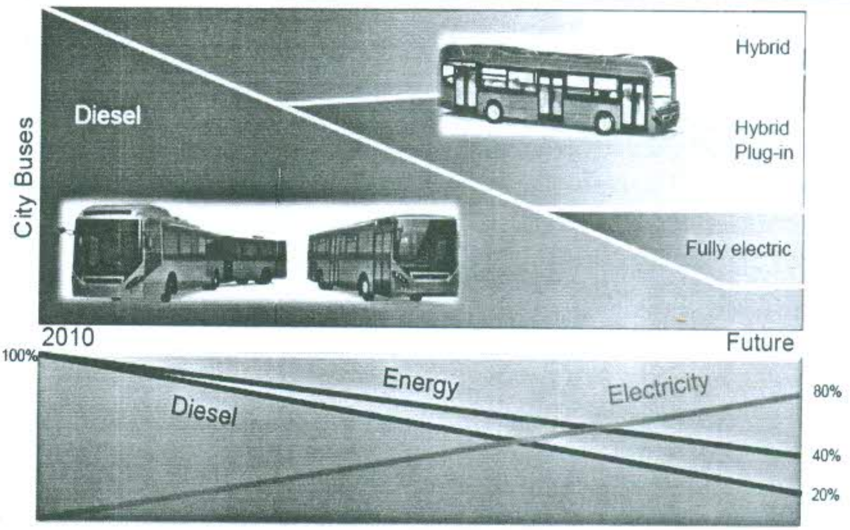


Figure 7: Global trend of BRT manufacturing and usage

Source: Siemens AG 2016

The dilemma then is the fact that the advanced countries of the world will no longer depend on the OPEC market for their energy, and countries like Nigeria whose foreign earning wholly depends on petroleum exportation will crumble economically and otherwise.

5. Smart City Movement

Traditionally, a Smart City has been defined as a city that uses information and communications technology to make its critical infrastructure, its components and utilities more interactive, efficient, making citizens more aware of them. It is another city management approach that has been introduced as a strategic device to encompass modern urban production factors in a common framework and to highlight the growing importance of Information and Communication Technologies (ICTs), social and environmental capital in profiling the competitiveness of cities. A city can be defined as 'smart' when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic development and a high quality of life, with a wise management of natural resources, through participatory action and engagement, (Caragliu et al. 2009; Giffinger et al. 2007; UCLG Babao2012). Therefore a hypothesized smart city function can be identified (and ranked) along six main axes or dimensions as follows according to the global smart city crusader:

i. a smart economy
ii. smart mobility
iii. a smart environment
iv. smart people
v. smart living
vi. smart governance.

5.1 Intelligent Transport System and the automobile

The concept of Intelligent Transport System (ITS) emerged in

1991, when transportation professionals recognized the significant roles that electronic technologies can play in optimizing surface transportation. It was the same year that the United States (U.S.) Congress legislated the national ITS program. Since then, computer, communication, and sensor technologies have improved dramatically, and ITS technologies have emerged in highway and public transit jurisdictions worldwide. According to EU Transport Research Team, 2016, the key accomplishments include the deployment of:

i. Real time urban traffic management and monitoring and incident notification;
ii. Traffic signal control and ramp metering to improve traffic flow and safety;
iii. Advanced Vehicle Control and Safety System, AVCSS,
iv. Improved traveller information; Advanced Traveler Information System, ATIS
v. Commercial vehicle screening and electronic toll collection;
vi. Satellite-based dispatching systems in public transit operations;
vii. In-vehicle navigation systems in private vehicles;
viii. Smart parking management;
ix. Eco-driving and eco-routing;
x. Ride sharing services via the Internet; and
xi. Car-sharing and public bike-sharing services.

For instance, the U.S. Department of Transportation (1970) reported that ITS spending is 10 times more effective in providing road capacity than spending on road building, and that, freeway management systems such as ramp metering have reduced crashes by nearly 50 percent while allowing 22 percent more traffic flow at speeds 13 to 48 percent faster than prior congested conditions. As against the manual enforcement of speed limit in some developing countries like Nigeria, road sensors sense the speed of approaching vehicles and display it in relation to the mandatory speed for the road lane for which drivers are expected to adjust their speed immediately to avoid penalties. See Fig. 8 for a typical ITS electronic installation for vehicular speed control.

Figure 8: Speed limit mobile sign post

ITS deployment to road traffic management has been grouped into eight according to their beneficiaries. This include: travellers information services, traffic management and control, drivers driving aid, commercial vehicle management, public transport management, emergency management, and safety enhancement, all these are further detailed in table 1.

Table 1: Division of ITS by ISO TC

Service category	Service No.	Service name
Travelers information	1	Pre-trip information
	2	On-trip driver information
	3	On-trip public transport information
	4	Personal information services
	5	Route Guidance and Navigation
Traffic management	6	Transportation planning support
	7	Traffic control
	8	Incident management
	9	Demand management
	10	Policing/Enforcing traffic regulations
	11	Infrastructure maintenance Management
Vehicle	12	Vision enhancement
	13	Automated vehicle operation
	14	Longitudinal collision avoidance
	15	Lateral collision avoidance
	16	Safety readiness
	17	Pre-crash restrain deployment
Commercial Vehicle	18	Commercial vehicle pre-clearance
	19	Commercial vehicle administrative process
	20	Automated roadside safety inspection
	21	Commercial vehicle on-board safety monitoring
	22	Commercial vehicle fleet management
Public transport	23	Public transportation management
	24	Demand responsive transport management
	25	Shared transport management
Emergency	26	Emergency notification and personal security
	27	Emergency vehicle management
	28	Hazardous Materials and incident notification
Electronic Payment	29	Electronic financial transaction
Safety	30	Public travel safety
	31	Safety enhancement for vulnerable road users
	32	Intelligent junctions

5.2 Decision Support System (DSS)

Decision Support System (DSS) is defined as a specific class of computerized information system that supports business and organizational decision-making activities. A properly designed DSS is an interactive software-based system intended to help decision makers compile useful information from raw data, documents, personal knowledge, and/or business models to identify and solve problems and make decisions. The DSS and its concept are widely used by transportation agencies for a variety of purposes ranging from transportation network planning to highway asset management and dangerous goods routing.

SDSS is an interactive, computer-based system designed to assist in decision making while solving a semi-structured spatial problem. It provides computerized support for decision-making where there is a geographic or spatial component to the decision. Computer support for spatial applications is provided by systems based around a Geographic (or Geographical) Information System (GIS) (Keenan, 2003). GIS was first used in the 1950's in North America, largely for the automated production of maps, but 1960's saw the introduction of many of the basic concepts in GIS.

In rout management decision making, the route manager can also carry out a broad range of "**What if**" simulations to find the solution that minimize cost. In Chicago for instance, there was reduced traffic congestion, better air quality, more efficient distribution of goods to businesses and stores, and an improved environment for pedestrians by implementing an off-peak delivery (OPD) program in congested parts of the town using SDSS in 2016. To make such a program happen, business and civic leaders will need to encourage it and the City would need to make it a priority. A formal pilot program could be a useful step to test the idea, measure the public and private benefits, and address possible concerns of supply chain carriers, businesses and residents.

The longest running OPD program is Pier Pass Off-peak, a business-led not-for-profit that has been effectively used in Los Angeles since 2005. Other OPD programs in the U.S. have been implemented for brief periods; some in Europe – Spain, for example – have lasted longer. A few full-blown congestion pricing schemes that apply to all vehicles have been used in places like London, Stockholm and Singapore; it was briefly considered, but not implemented, in New York. Much has also been written about a pilot OPD project tested in New York City that achieved promising results. Deliveries likely represent more than 80% of the entire freight traffic in urban areas (Holguín-Veras et. al, 2010).

Holguín-Veras and Aros-Vera (2014) opine that a self-supported freight demand management system (SS-FDM) based on a toll-surcharge to vehicles that travel during regular hours could generate enough funds required for a financial incentive and improvement towards its sustainability. The incentive is aimed at increasing the acceptance of off-hours delivery and industry flexibility. For instance, Off-peak delivery was used as a strategy to manage unusually high levels of congestion during the 1984 Los Angeles Olympic Games, the 1996 Atlanta Olympic Games, and the 2012 London Olympic games.

SDSS generally depend on series of software which also depends on the model, the aim and use of the system. For example, **Route Monkey** delivers beyond route planning and can reduce fleet costs by up to 20% and substantially reduce carbon emissions, delivering a rapid return on investment. As part of the Trakm8 Group, Route Monkey can provide a fully integrated telematics and fleet management solution, including vehicle tracking, tachograph analysis, dashboard cameras and driver behaviour.

6. The Africa (Nigeria) Dilemma

Sub-Sahara African Countries is at the receiving end of the automobile technological advancement since they are more of consumers than producers. The desire to be at par with the developed countries in term of human growth and development that is exacerbated by the global village syndrome culminated into the following challenges:

I. Automobile Waste Trade

The technological advancement in the transport sector has introduced more environmental friendly vehicles and stressful free autonomous vehicle, hence de-registration of old model ones and there shipment to other less developed countries of the world. Sub-Saharan Africa countries appear to be handicapped economically hence their over dependent on the importation of out modelled used cars popularly called "Tokunbo" and even End of Life Vehicles (ELVs) (Myrsini et al, 2007). The European Environment Agency estimated the number of end-of-life vehicles arising in the EU-25 to be about 14 million in 2010, compared to 12.7 million in 2005. Sea Ports like Cotonou in Benin and Togo are the busiest in West Africa aside from Lagos port in Nigeria that receive between 3 to 4 million used or second hand cars from Europe, cars coming from Germany and France primarily. Most deals are made on the streets behind the ports, where typical dealers are bypassing brokers by sending their cars to ports such as the Port of Antwerp to make deals on the spot from buyers coming directly from Africa.

According to the National Bureau of Statistics, Nigeria has an estimated vehicle population of 11,458,370 as at the first quarter of 2017, which is classified according to usage in table 2.

Table 2: Classification of Vehicle in Nigeria as at 2017

S/N	Ownership	Number	Percentages
1	Commercial	6,164,603.06	53.8
2	Private	5,098,974.65	44.5
3	Government	183,333.92	1.6
4	Diplomats	11,458.37	0.1
Total		**11,358,370**	**100**

Source: National Bureau of Statistics

The predominant driving force behind the importation of these materials has been the desperate desires of these countries to enjoy those products and be at par socially on one hand, and at the other hand earn import duties in an attempt to alleviate the economic hardships as in Benin Republic where Nigerians go to smuggle vehicles to their country apart from those entering through the seaport. But the challenge now is how to manage the dumping of used and out-modelled cars on the vast of committed and uncommitted land available in many African countries, Agbo (2011), See Fig. 9 for Lagos, Nigeria's seaport.

Figure 9: Lagos, Nigeria's Seaport with agglomeration of second hand vehicles

According to the Austrian "Die Presse", from the year 2010, 400,000 vehicles per year are shipped to Africa (some illegal) by the shipping company Grimaldi (Hamburg). It is also reported that 170,000 vehicles are shipped by Unikai in Hamburg, of which half of this is destined for Africa. This gives evidence that considerable quantities of ELVs are exported illegally from European Member States; predominantly to Africa. This is supported by the inspections activities carried out by IMPEL-TFS project, where several cases of illegal shipment of end-of-life vehicles were exported – mostly to African countries (EU on ELV, 2010, Irene, 1996) as displayed in Fig. 10.

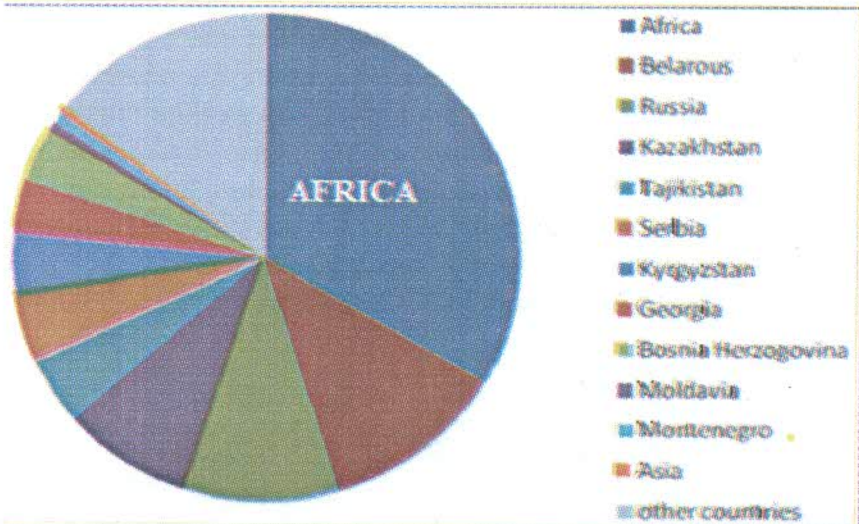


Figure 10: Main destinations for used cars out of the EU-27 in 2008 (in units)

Source: IMPEL 2006, 2008, Umweltbundesamt based on data provided by COMEXT database.

The statistics also shows that the highest number of used vehicles came in January with 9,107 vehicles, followed by 8,900 used vehicles in February 2012. March had the least figure, which was given as 6,477 vehicles; see Fig, 11 with Nigeria leading among the other West African countries.

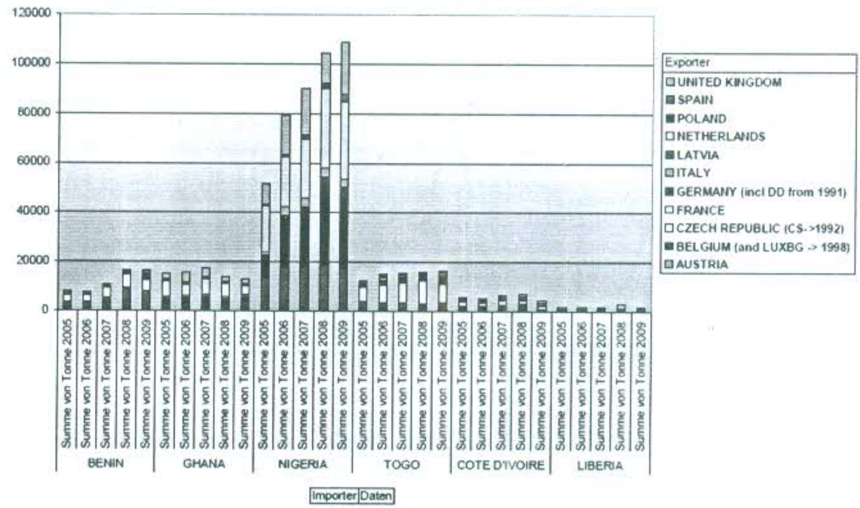


Figure 11: Seaborne import of vehicles designed to carry freight in tonnes 2005 – 2009. EUROSTAT data

Source: Öko-Institute, 2010

Although the import statistics for used vehicles is a bit fuzzy, the Director-General of National Automobile Council, Mr. Aminu Jalal, gave the total number of vehicles imported into the country annually as 280,000 units in 2012. He specifically said Nigeria was spending N400bn annually on the importation of 200,000 used and 80,000 new vehicles. But in 2017, Nigerians spent about ₦600 billion on importation of vehicles, about 50,000 new and 150,000 used vehicles, see Fig. 12 for the vehicle importation composition where used cars top the chat.

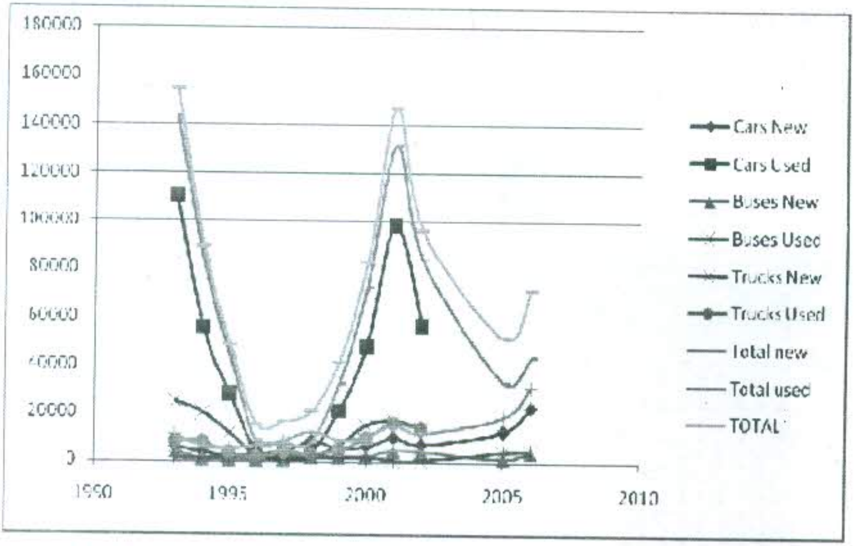


Figure 12: Statistics of Imported Vehicles to Nigeria (1990 – 2010)
Source: Manufacturers, OMI India

ii. **Automobile and Environmental Pollution**

Among the major concern of environmental impacts of imported ELVs/used cars is sulphates emission. For engines operated with premium leaded gasoline (up to about 3ml/gal tetraethyl lead additive) the vehicle mass emissions range from about 0.1 to 0.5g/mile, Okeke et al (1997). These values are significantly larger than mass emission from vehicles operated with unleaded fuel. Ajayi and Dosumu (2002) in another study revealed that between the year 1988 to 2005, Nigeria imported roughly about 379,334 used vehicles which emitted about 1,518,136 NOx, 34,158,060 CO, and 6,072,544 HC pollutants into the atmosphere.

The age of used vehicles permitted into the country is still a major problem comparatively. While countries like Angola do not permit the importation of vehicles above 3years into their country, Nigeria officially allows up to 10years currently aside from the older ones being smuggled in. Table 3 show the current vehicle importation policies of some African countries in comparison to Nigeria.

Table 3: Age of used vehicles importation into African countries

COUNTRY	IMPORT CONDITION
Angola	No acceptance of Vehicles older than 3 Years.
Egypt	April 28, 1999 must be only one POV is allowed to be imported equipped with a catalytic converter.
Gabon	No Vehicles older than 3 Years. Must obtain an inspection BIETC Number prior to shipping.
Ghana	Vehicles older than 10 years are subject to additional Taxes and Duties
Coted'Ivoire	No Acceptance of vehicles older than 7 Years and H/H older than 10 Year
Kenya	No Acceptance of Vehicles older than 8 Years
Liberia	No acceptance of vehicles older than 10 Years
Nigeria	No acceptance of Cars/Vans/Pick Ups older than 15Years
Senegal	No vehicles older than 8 years allowed into the country
Tanzania	No Vehicles older than 10 Years
Tunisia	No Acceptance of Vehicles older than 5 Years. All H/H Cargo must be Manufacturer New.

Onitsha, Nigeria according to the WHO (2017) data; is the most polluted city in the world, as a fast-growing port and transit city in south-eastern Nigeria that recorded nearly 600 micrograms per cubic metre of PM10s - around 30 times the WHO recommended level of 20 micrograms per cubic metre, as displayed in Fig. 13. Outdoor air pollution causes more than 3m

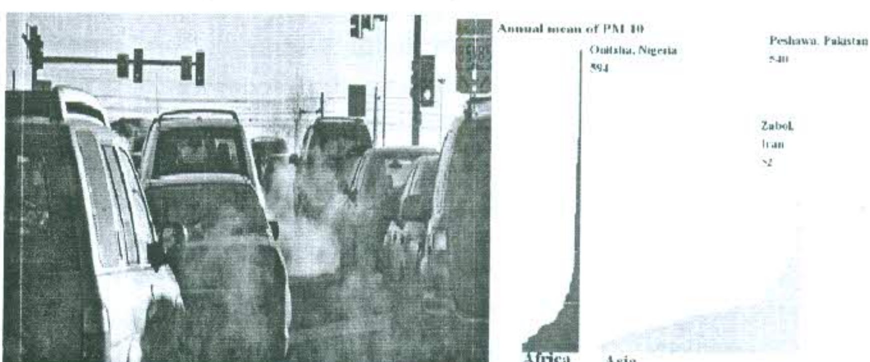


Figure 13: Poor combustion of fuel in old cars and industries within the city. (WHO, 2017)

deaths a year - more than malaria and HIV/Aids - and is now the biggest single killer in the world. The toll is expected to double as urban populations increase and car numbers approach 2bn by 2050. Air pollutants such as sulphates, nitrates and black carbon penetrate deep into the lungs and into the cardiovascular system, This according UN, poses the greatest risks to human health globally.

Although China has been plagued by air pollution for long, it has improved its air quality since 2011 thereby having only five cities among the top 30. Nine other countries, including Pakistan and Iran, have one city each in the worst 30.For the larger, but slightly less dangerous PM10 particles, India has eight cities in the world's top 30. Nigeria, Saudi Arabia and Pakistan each have two cities in the top 10. This phenomenon of global air pollution is likely to be growing worse because only a few African cities monitor their air pollution levels.

iii. Ill informed Auto Mechanics (Auto Ben-Search FM)

Studies have long shown that the educational level of the owners of a business enterprise is a significant factor that influences their level of efficiency. Ajibefun and Daramola (2003), examined the efficiency of micro enterprises including auto-mechanics in Nigerian economy using a sample of 180 micro enterprises, provide evidence of wide variations in technical and functional efficiencies, both within and across industries.

Most often, frustration is the lot of majority of auto vehicle users in Nigerian cities; in many cases in our environment, simple faults have proven very difficult to fix or overcome by supposed automobile experts and technicians (Dukiya and Owoeye, 2014). Some car owners have had to resort to multinational workshops like: Peugeot, Toyota, Honda Place, Kia Motors, etc for repairs after repeated visits to the local auto-workshops, which often seem to possess insufficient required skill with which to understand and solve new model vehicles' problems. The fact that the multinational workshops are expensive and inaccessible to the general masses, the majority have continued to have more and more vehicles abandoned by their owners. It has been reported on not few occasions that vehicles come out of the mechanic workshops either worse off than they were taken in or that other nonexistent problems have been created and used to replace that for which the vehicle was brought to the garage in the first place.

Many uncountable automobile skill, semi skill and even apprentices focused more attention on reward for service not well delivered instead of learning the trade. Some bolted out of training to establish their own workshops before completing the skill acquisition term and obtaining certification, popularly known as freedom. Thus they mostly end up half baked and corrupt, using patronizers to experiment by guesswork.

The fact remains that the few of them that were certificated were trained with old model vehicles and never engaged in training-the-trainer national and international programmes under the continuous excuses of no financial assistance. This should be a national and regional challenge in the transport industry and policy makers in correcting the socio-economic ill. There is a need for deliberate effort to adapt some functional entrepreneurial policies in the area of automobile technician by the African countries if Bus Rapid Transit (BRT) scheme is to be sustained in the continent.

The differentiating element between a digital city with Hybrid Bus Rapid Transit (HBRT) and a smart city is Smart People. People are smart in terms of their skill and educational levels, as well as the quality of social interaction in terms of integration and public life and their ability to open to the "outside" world. A key element in the development of cities is having well-educated citizens. In addition to having well-educated citizens and a university with a major presence in the city, another priority is to adapt the educational offer, especially considering the changes that society is going through due to globalization and the advancement of new technologies. The question is "*which African country can boast of smart city and smart people*", the answer is in the negative including even South Africa. New technologies are evolving at breakneck speed; therefore, it is important to design digital development plans in classrooms that mainly focus on closing the digital divide, promoting the digital skills of teachers and incorporating the new generation of digital learning resources. All these can be resolved through the following:

i. Short terms Certificate of Professional Competence (CPC) Programmes that will lead to re-certification of Practitioners should be introduced by the relevant governmental agencies.

ii. Manufacturers and Organised Auto Dealers should be compelled by regulation to train Mechanics/Technicians and thereafter appoint them as Accredited Independent Service Providers (AISP). Continuing Professional Development (CPD) programme should be included in the package so as to ensure their skills are kept up to date.

iii. Meaningful engagement of government in dialogue by sector practitioners for easier access to finance and equipment. Import tariffs and price regime of working tools can be deliberately be regulated by government.

iv. Corporate engagement of financial institutions by sector to seek alternative means of accessing funds.

v. All Practicing Mechanics/Technicians should be registered by the State/Local Government, issued with a practicing identification so as to distinguish qualified ones from quacks.

iv. Foci fuel/foreign earning and budgetary

It's astonishing to note that transport that use to consume up to 92% of fossil fuel in 2014 now ranges between 60% and 78%. There is a contrasting range of expectations for adoption of hybrid vehicles, for instance OPEC is forecasting about 1.7 million electric vehicles to be on road by 2020, (WEC, 2017). More so, Paris, Madrid, Athens and Mexico City have already proposed to ban the most polluting cars and vans by 2025 as a way of tackling air pollution. Four of the world's biggest cities are to ban diesel vehicles from their centres within the next decade, as a means of tackling air pollution, with campaigners urging other city leaders to follow suit. If France's Environment Minister has his way, the country could join a small but growing list of countries that plan to ban vehicles running on gasoline, diesel or other fossil fuels. The proposal was announced recently by Environment Minister Nicolas Hulot which tends to coincide with the **G20** meeting in Germany.

European countries especially France in particular, are already working to establish a network of public charging stations, making it easier to own and operate plug-based vehicles. Even before the total ban on internal combustion engines was proposed, Paris is laying out plans to end sales of diesel vehicles which have taken much of the blame for that city's worsening smog problem. At least four countries intend to go 100 percent zero-emissions vehicles - which could mean either BEVs or hydrogen fuel-cell vehicles.

Norway has laid out the most aggressive plans. It wants to get there by 2025. It helps that a full 24 percent of the vehicles sold in this oil-rich nation already are battery-electric. India wants to get all of its vehicles switched to battery power by 2030 - and that means it not only wants to end the sale of internal combustion vehicles but convert or replace all other vehicles already on the road by the end of the next decade, a goal few see possible. The Netherlands already has a relatively high Electric Vehicle (EV) sales rate, about 6 percent of its total new vehicles, but it has yet to formally lock down a switch to electric vehicles some would like to implement by as early as 2025. Germany may also push to end sales of gas and diesel cars by 2030, but there is strong opposition, especially since half of its electricity comes from coal. Yet German automakers are launching major drives to electrify and that could help build momentum for a switch. Researchers like Jean (2006) in China have been working on the future of fossil fuel and now, China is using both the carrot and stick to increase sales of so-called New Energy Vehicles.

In summary, from the discussion so far, and as revealed in Fig. 14, the world consumption of petroleum products for mobility is nose-diving and what is the hope of countries like Nigeria that still over depend on oil revenue for her development.

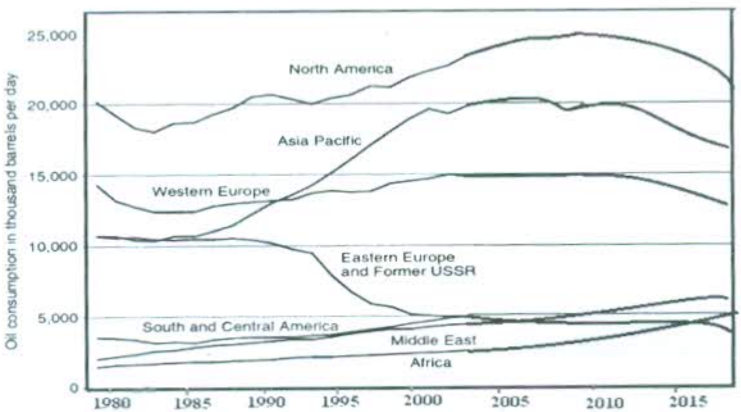


Figure 14: Oil Consumption per region of the world

For instance, Nigeria earned a total export receipt of US$476.25mn in December 2017, from sale of crude oil and gas as against US$201.11mn in November 2017 (NNPC, 2017). According to the report, while receipts from crude oil amounted to US$342.16mn, gas and miscellaneous receipts accounted for US$94.85mn and US$39.24mn respectively. The report further showed that from January to December 2017, NNPC remitted a total of US$2.38bn into the Federation Account, US$1.79bn for Joint Venture financing, and US$53mn to the Federal Government for debt repayment. Table 4 clearly reveals the dwindling oil revenue from the petroleum sector to the Federal Government and invariably the entire country. For instance, in the table, the oil revenue sector started to experience downward trend from year 2012. Hence the clamor for Internally Generated Revenue (IGR) that dough tail to University income Tax remittance saga in Nigeria.

Already, Saudi Arabia has embarked on what she calls a National Transformation Plan outlined in a document known as Vision 2030 that aims to leverage current oil revenues to provide long term investments necessary for a future beyond oil. What is the vision and plan of Nigeria beyond oil, is it insurgencies in the rural areas that is anti food security.

Table 4: Summary of Federal Government Finances (N' Billion)

Item	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016*
Total Fed. Collected Rev.	5,965.10	5,727.50	7,866.59	4,844.59	7,303.67	11,116.90	10,654.75	9,759.79	10,068.85	6,912.50	5,679.03
Oil Revenue	5,287.57	4,462.91	6,530.60	3,191.94	5,396.09	8,878.97	8,025.97	6,809.23	6,793.82	3,830.10	2,693.91
Non- Oil Revenue	677.54	1,264.60	1,336.00	1,652.65	1,907.58	2,237.88	2,628.78	2,950.56	3,275.03	3,082.41	2,985.13
Federation Account	3,219.10	3,878.50	4,552.84	3,600.07	4,784.47	6,158.40	6,565.24	7,488.30	7,540.32	5,845.83	4,523.45
Fed. Retained Rev.	1,836.61	2,333.66	3,193.44	2,642.98	3,089.18	3,553.54	3,629.61	4,031.83	3,751.71	3,431.07	2,952.51
Total Expenditure	1,938.00	2,450.90	3,240.82	3,452.99	4,194.58	4,712.06	4,605.39	5,185.32	4,587.39	4,988.86	5,160.74

Source: National Bureau of Statistics

7. Our Contributions

Mr. Vice-Chancellor Sir,

In the last 15years, our research efforts have been focused on spatial interaction and the adoption of automated transportation planning and management. Some of which are presented below:

I. Geospatial Analysis of End-of-Life/Used Vehicle Dumps in Africa: Case Study of Nigeria (2016)

Spatially, the determination of land use allocation by the market forces is anti sustainable city development as it is in most Nigerian urban centres. Used vehicle dealers are now occupying most urban open spaces and reserved areas for the display of their wares. In Abuja, the Federal Capital City (FCC) of Nigeria that is located within the Federal Capital Territory (FCT) as a planned city built in the 1980s, has a total area land coverage of about 250km^2. But because it is the city of the affluent people, most of the vehicle dealers have their branches scattered all over the city taking pocession of any available open space for the display of their goods. Table 5 show the list of the major vehicle dealers and the area coverage. The approximate total area coverage of these dealers is **1.13km^2** which is about 0.452% of the city land area.

Table 5. Area Coverage by major ELVs/Used Vehicle Assemblage in Abuja, Nigeria

S/N	Name	Area Covered (m^2)	Location (Easting/Nothings)
1	Pacific motors	519.12	326069/1008178
2	Ken lupa	486.62	326187/1008175
3	Jazzy motors	319,12	326365/1008167
4	Abuja motors	2121.16	326606/1008155
5	Mtech motors	2001.11	326633/1008153
6	Jabi 1 motors	3012.72	325923/1005248
7	Jab motors	1512.12	328568/1008092
8	Jab 2 motors	998.98	329230/1008686
9	Okche motors	1549.42	333756/997873
10	A motors	4941.12	334545/998474
11	Mansel motors	2111.12	334386/998327

12	Kia-Dana motors	3541.12	335094/999144
13	Ineh-mic motors	1054.12	334880/998885
14	Victory motors	3471.82	330693/1008151
15	Katape motors	5970.05	327591/1008185
16	Auto plaza exodus	16538.59	322432/1008714
17	MA Bature motors	2371.22	322133/1008756
18	Dustse motors	1919.01	320095/1009844
19	Arthom motors	1515.15	319366/1009972
20	Dut motors	6034.76	319787/1010028
21	Dotal motors	3453.12	319658/1010116
22	DCT motors	1368.39	319457/1010254
23	Gwari motors	2594.35	324979/1008263
24	Embassy motors	912.59	325041/1038235
25	MD Truck	2921.11	325128/1008233
26	Kamama motors	3119.15	325659/1008206
27	Spencer motors	3471.15	325723/1008202
28	Izasis motors	4009.21	319869/1009873
29	Shansa motors	3949.25	320249/1009609
30	YecoAlafemi	5079.49	320541/1009361
31	Hill crest motors	2021.81	323135/1008537
32	Exodus motors	3434.00	315212/1010748
33	Total motors	11963.68	314623/1010759
34	More motors	3040.00	314169/1010699
35	Jabi motors	2000.00	313160/1010536
36	Dadei motors	308.50	308602/1007541
37	Flags motors	4523.54	308025/1006971
38	Acak-Aze motors	590.452	313471/1010389
39	Kalo motors	5009.42	315062/1010625
40	AMS motors	4869.92	318529/1010710
41	Freedom motors	18123.22	316282/1010768
42	Anmu motors	5071.43	318624/1010714

Source: Field work, (2016)

In Minna, the state capital of Niger State that is about 200km from Abuja, There are about seven (7) major vehicle dealers occupying about $0.14km^2$of land while other motor mechanic junk shops cover about $2.15km^2$ in the town.

This study is intended to reveal the level of urban land use budget encroachment occasioned by indiscriminate sitting of used car markets and the spate of abandoned End-of-Life vehicles in every available urban space. Almost every compound in Nigerian cities today is littered with End-of-Life vehicles at the expense of other land uses. The truth is that African countries and Nigeria in particular has been and will continue to be the dumpsite for out modelled vehicle that are housing rodents, hoodlums and visual nuisance unless stringent measures are taken by the government.

ii. Road Safety and Vehicular Light Standardization in Nigeria Amidst American and UN Regulation Standard (WP.29). (2014)

This study assesses road users' perception and responses to red signal-lights of new/second hand vehicles imported into Nigeria and theoretical review of human vision.

Turn signals — formally called "directional indicators, (signals, "blinkers", or "flashers") are blinking lamps mounted near the left and right front and rear corners of a vehicle, and sometimes on the sides, activated by the driver on one side of the vehicle at a time to advertise intent to turn or change lanes toward that side. As with all vehicle lighting and signaling devices, turn signal lights must comply with technical standards that stipulate minimum and maximum permissible intensity levels, minimum horizontal and vertical angles of visibility, and minimum illuminated surface area to ensure that they are visible at all relevant angles, do not dazzle those who view them, and are suitably conspicuous in conditions ranging from full darkness to full direct sunlight.

As vehicle turn-signals developed and became standardized over the past centuries, differences arose in the European and United States standards (Moore & Rumar, 1999). One major difference is that while European standards, governed by the Economic Commission for Europe (ECE), require rear turn signals to be exclusively amber (yellow), the United States, (FMVSS) 108 allows rear turn signals to be *either* amber or red as in Fig. 15.

Figure 15: Nissan Altima MY 2005, red turn signals; 2002-2004 amber turn signal

The majority of Nigerian road users, for example, might recognize amber rear-turn signals more quickly than the red because they may benefit from the redundancy in colour-coding the turn function (i.e., amber means turn, red means stop); in contrast, only young and perceptive drivers will recognize that a red signal could indicate a turning or braking vehicle and base their recognition on other signal cues (e.g., flashing lamps, asymmetric lamp illumination).The result reveals that about 76% of the road users have low perception of red turning-signal and that poor utilization of turning-signal are responsible for 45% intra-urban road crashes.

Human vision, perception and reaction time decline with advancing age. As detailed in table 6, vision capacity decline along aging, and time of the day. Presently in Nigeria, there is no effective control of vehicle drivers across the country, and both the new divers' license and plate number has being highly crippled by politicking. The fact is that, about 70% or more of urban vehicles on road have been dented due to poor vehicular blinkers. Where riotous vehicle blinkers are in use like in US, drivers visual test are paramount in the issuance of drivers' license. This is unlike what is obtainable in Nigeria where drivers' license can still be obtained in proxy.

Table 6: Light Vision Capacity according to Age

Age (yr)	Day (mm)	Night (mm)
20	4.7	8.0
30	4.3	7.0
40	3.9	6.0
50	3.5	5.0
60	3.1	4.1
70	2.7	3.2
80	2.3	2.5

In the light of the above discussions, it is imperative that:

i. The federal government should as a matter of urgency redefine her stand in the UN Harmonization of Vehicle Regulations (WP.29, 2005)".

ii. That if Nigeria will continue to import vehicles from continental blocks, then certain road infrastructure and regulatory laws that call for the adaptation of Americans' vehicle to Nigeria UN standard codes should be put in place for the safety of the national highways.

iii. The custom officers right from the port of entry should enforce the corrective measures on American vehicles with; red-turn signal lights and other cosmetic none essential glaring snow, fog, run lights that are causing lots of road mishaps which the FRSC is currently battling with.

iii. Emergency Ambulance Service Scheme in Road Traffic Accident Rescue Operation; the Case of FCT Abuja, Nigeria. (2016)

As a result of the increase in road traffic accidents and the involvement of Federal Road Safety Corps in the rescue and management of road crash victims in the Federal Capital Territory (FCT), this study deemed it apt to examine the effectiveness of the Emergency Ambulance Service Scheme (EASS) in road traffic accident in FCT Abuja. The study revealed that the level of awareness of the existence of the Abuja Zebra crew ambulance services is still very poor and that most accident victims were being conveyed to the hospital via private or public vehicles. It also revealed that road safety Zebra crew are still operating below the GOLDEN HOUR given by global standard as within 1 to 20 minutes of vehicle crash.

The efficiency and capability of any agency is a function of availability and quality of the equipment in use. Table 7 revealed the adequacy of operational equipment available to the Zebra crews in FCC in relation to minimum global best practices. For instance, only 6 as against 12 Laryngeal Mask Airways available to the crew men, this cannot handle mass casualties.

Table 7: Ambulance Equipments in Abuja FRSC Zebra Scheme

S/N	Name of Equipment	No. Available	Standard No. Required	Deficit
1.	Personal Protective Equipments			
	Gloves: Sterile (5-8) each	2 pairs	4 pairs	2 pairs
	Clean (pairs unisize)	4 pairs	12 pairs	8 pairs
	Disposable Bags (Biohazard)	1	6	5
2.	Stretcher	1	2	1
3.	Scoop	1	2	1
4.	Spinal Board (adult and child) each	1	1	0
5.	Quick Extricating Device	1	1	0
6.	Cardiac Monitor/Defibrillator	1	1	0
7.	Oxygen therapy equipment	2 cylinders	4 cylinders	2 cylinders
8.	Aspirator (suctioning) equipment	1	1	0
9.	Airway maintenance equipment	1	2	1
10.	Laryngeal Mask Airway	6 pairs	12 pairs	6 pairs
11.	First Aid Box	1 set	1 set	0

Source: Field Survey, (2015)

In term of response to distress calls, 97% of the total respondents believed that the Abuja Zebra crew has effective communication gadgets for distress call, but the assessment of response to emergency calls revealed that only 38.8% were of Road Safety Zebra crew, 16.4% were of National Emergency Management Agency, 26.4% were of FCT Police Command, and 18.4% were from Nigeria Security and Civil Defence Corps. This implies that more than half of the distress calls responses are from other agencies like NEMA, Police and NSDC in Abuja Municipal Area Council, and that the response time still ranges between 3 to 40 minutes

This study that assessed the effectiveness of Emergency Ambulance Service Scheme in Abuja Municipal Area Council (AMAC), was juxtaposed with the global best practice of a minimum response time of 1–20 minutes. This is a challenge to African countries and particularly Nigeria where her capital territory has the highest fatality rate of road traffic crashes of 33.48 crashes per 10,000 vehicles and 13.86 deaths per 100,000 of the population for the first three quarters of 2017 (January to September) according to the FRSC report. A situation where most accident victims are still been conveyed to the hospital via private or public vehicles is ethically unacceptable. There is much to do at the national, state and NGOs levels in addressing the ugly trend.

The study therefore recommended additional two (2) Zebra crew locations to be located along Airport road and NICON junction. The existing number of emergency ambulance vehicles and manpower should be increased in order to meet the global standard.

iv. Space Technology in Transport Disaster Search and Rescue Operation: The Challenge for Africa, (2014)

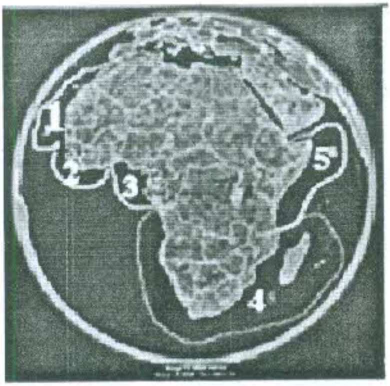
Disasters are sometimes natural, human induced or both. But the long time-lag between the occurrence of mishap and the rescue operation carried out is the major factor responsible for the great loses of life and properties especially in the developing countries like Nigeria with high road and air accident records. This study assessed the effectiveness of the use of space technology in the provision of timely and qualitative information that facilitates the works of the disaster management agencies; especially in critical decision making for better preparedness in Africa and Nigeria in particular.

African countries bordering the Atlantic and Indian Ocean have some MOU on maritime rescue regional grouping with major countries heading each group. The South Africa sub-regional group appears to be more organized and more pro-active than others like Nigeria sub-grouping, see figure 16 for the maritime grouping.

1. MOROCCO
Algeria, Morocco, Canary Islands, Senegal, Mauritania, Gambia, Cape verd and Guinea-bissau.

2. LIBERIA
Guinea, Liberia, Sierra Lione, Ivory coast, Ghana and Togo

3. NIGERIA
Benin, Nigeria, Gabon, Equatoria Guinea, Cameroon, Saotome and Principe



4. South Africa
Angola, Namibia, Komoros South Africa , Madagascar Mozambque

5. KENYA
Tanzania, Kenya, Somalia and Seychelles

Figure 16: Nigeria Position regional coastal management

Nigeria that is often referred to as the giant of Africa is yet to fully organize a well-coordinated space technology based search and rescue operation. For instance, how can one explain the episode of the Bellview Airlines crash on Saturday at about 20.45 (19.45 GMT) on its way to Abuja from Lagos that was first reported found on Sunday morning by a police helicopter search team near Kishi, Oyo state,400 km (320 miles) from Lagos; and was later found at Lissa in Ogun state, about 50 km (30 miles) from Lagos, (Allafrica.com, 2010, NEMA, 2012). According to (Yusuf and Ikechiji 2008) a vast country like Nigeria has only one search and rescue helicopter that is parked in the "Office of the President".

The study revealed that rescue operation in Nigeria is still analog comparatively and ill equipped where every national issues are politicized. That NEMA Headquarter and its operational offices lack real-time remote sensing equipment for total surveillance of the country. It is also established that there is over dependent of state and local governments on the Federal Government for minor and major disaster interventions that still lack real-time response to distress calls. More so, for NEMA to have only one Helicopter that is in the custody of the presidency is an aberration where every Regional Coordinating Centres should own a functional helicopter crew. It is therefore recommended that:

i. The existing law establishing NEMA should be reviewed to have a legislative power to influence the state SEMA's activities for effective synergy and implementation of national platform plans.

ii. NEMA should have a legislative power to call upon allied agencies and departments that are signatory to SAR mission when their support services are required.

iii. There should be hierarchical regional, states, local government and municipal disaster emergency coordinating units with relatively up-to-date Radar system and communication equipments to respond to issue within their jurisdiction or send distress call to NEMA.

iv. The Unified Command structure should issues operation orders and mission assignments.

v. To activate responses based on the scope and magnitude of the threat or incident as indicated in the proposed organizational structure. The coordinating centre is to establish communication links with support agencies and regional coordinators which will provide the relevant agency and other stakeholders with Situation Status (SITSTAT) and Resource Status (RESTAT) as required, (COES, 1999).

vi. A more dynamic synergy and coordinated SAR operation that leverage on remote sensing techniques should be developed.

v. *Speed Limiting devices and the Nigerian's FRSC Intelligent Transport System Adaptation a mirage*

An average of 56 people die in road crash daily conservatively and about 60 people are being injured in road accidents daily according to the official statistics from the Federal Road Safety Corps (FRSC) and National Statistics Bureau (NSB). Speeding is a critical factor in every serious crash, and speeding contributes about 36% of fatal crashes. The risk of a casualty crash approximately doubles with each 5km/h increase in speed on a 60km/h speed limited road, or with each 10km/h increase in speed on 110km/h roads. It is illegal to drive at any speed above the speed limit. Vehicle travel speeds affect both the risk of crash involvement and the severity of crashes, and subsequent injuries. A driver will need at least 18.59m and 1.07 seconds to stop a vehicle travelling at 15.53 km/ph, and a length of 106.68m and 3.2 seconds are required to stop a vehicle travelling at 43.49km/ph. For instance in Nigeria, urban and rural roads have 45km/h and 100km/h mandatory speed limit respectively.

The study observed that neither the FRSC nor the traffic unit of the police has the required ITS mobile infrastructure to commence the vehicle tracking as envisage in the new plate number. Many Nigerian cities are still growing organically, no

Figure 17: A mobile tracked system of the US Police FRSC patrol vehicle of Nigeria

geo-referenced cadastral maps for street naming. Major road networks in the country lack necessary ITS infrastructure. A comparative assessment of the Nigeria's FRSC patrol car and that of other countries like USA reveal the level of preparedness of the commission and the country at large is substandard as revealed in Fig. 17.

Recommendations

i. All the major urban centres and highways in the country should be fully covered with current cadastral maps that are geo-reference for ITS adaptation. Most structures in some urban centres have no definite description of location and defined road network.

ii. It is recommended that the FRSC in conjunction with other relevant government agencies convene a standing technical advisory panel comprising individuals with backgrounds in the disciplines central to the design, development, and safety assurance of automotive electronics systems, including software and systems engineering, human factors, and electronics hardware. The panel should be consulted on relevant technical matters that arise with respect to all of the agency's vehicle safety programs, including defect investigation processes and research needs assessments.

iii. The speed control devices are just a subset of a set in the whole gamut of ITS adoption for speed control, traffic surveillance, security and management. A strategic long and short range plan should be evolved and doggedly implemented for the country.

vi. Vehicle-Actuated Intersection Road Traffic Management Signalling

Traffic signals generally are designed and installed to ensure an orderly flow of both human and automobile traffic at intersections and it help in reducing the number of conflicts among road users from different directions at the point of convergence. It operates by assigning priorities to various traffic movements to influence traffic flow.

Effective traffic signaling system has the following advantages:

. It Increases road capacity at intersections;

. Reduce frequency and severity of certain types of crashes,

. Provide for continuous flow of traffic at a reasonable speed along a given route;

. Interrupt heavy traffic in a lane at intervals to permit access to other road users.

Fixed-time traffic signals are not without some setbacks like excessive delay and increase rear-end collisions. It follow a predetermined sequence of signal operation, always providing the same amount of time to each traffic movement, whether traffic is present or not.

Actuated traffic signals change the lights according to the amount of traffic in each direction. They use various types of sensors to detect vehicles, and adjust the length of the green time to allow as many vehicles as possible through the intersection before responding to the presence of vehicles on another approach.

In a field survey carried out at Shiroro road intersection solar powered traffic signaling, the following findings were observed:

i. That the whole system operate on a stand-a-lone principle

ii. It is a time-fixed operation system that has no regard to vehicular presence.

iii. The operational system causes delay in scheduling right of way for busy lanes.

iv. Special vehicles like Ambulances and Fire Fighting Engines are often trapped among queuing vehicles along a road lane that is denied access.

v. That it lack the relevant sensors installation for traffic data collection.

vi. It is weather dependent and malfunction at ease.

vii. It has no central monitoring or control point for prioritization of road users.

We in the Department of Transport Management Technology in collaboration with the Department of Computer Engineering therefore carried out a traffic volumetric survey on the four lanes to determine the h erarchical and the dynamic flow at that junction in order tc develop a locally made vehicle actuated traffic signaling system that will can solve the above listed problems associated with time-fixed signaling operation systems.

Figure 18: Google Image of Shiroro road Minna intersection with time-fixed signaling

Conclusion

According to the Nigerian National Petroleum Corporation's (NNPC) financial and operations report for December 2017, Nigeria earned US$476.25mn from crude oil and gas. Yet industrial take-off is foot-dragging due to the system of governance that presents a façade of democracy but lack its substantive elements. The mixed regimes are inherently more unstable and prone to disruptions. The Nigerian population with a median age of 19 in comparison to that of France which is 41 (a relatively young country by European standards)tend to be more turbulent due to joblessness and high rates of urbanisation couple with social exclusion that trigger instability. The loss of oil revenue due to technological advancement in the transport sector is now aggravating the whole economic quagmires in the country and the region in general.

While all these characterizes African countries, the G8 (Canada, France, Germany, Italy, Japan, Russia, the United Kingdom, and the United States) are on the run especially in the area of Green Mobility. The world's transport industry is changing in response to the climate change and urban traffic gridlock challenges and no nation can afford to seat on the fence but join in the crusade of 'green mobility' for the optimization of vehicular usage.

The globalization of transportation standards and hybrid vehicles require the adoption of ITS principles and infrastructural development that must be strategically planed and not by piece-meal approach as it is in developing countries like Nigeria (Yusuf Alli and Ikechiji, 2012).

The Way Forward

i. The Federal Government needs to scale-up the maximum vehicle age that can be imported into the country; like other northern African countries that permit maximum age of 5years into their country. Like some of the Asian countries, the federal government should adopt the 'carrot–and–stick' approach in automobile importation in favour of modern and newer vehicles.

ii. Nigeria Automobile Villa' time-to-decide is now. Virtually all the conventional and technology universities in the country has produced one automobile spare part or the other like FUT Minna that have produced brake pad, crankshaft and others parts. Those inventors should be pooled together into the villa with mandates and timeline.

iii. Since there is nothing like technology transfer in reality, the federal government should pursue the reverse-technology vigorously like China that is now priding itself in KIA and Hyundai motors. Let us stop politicking and empower Aba and Nnewi.

iv. Since studies have proved that going by the present global oil production and consumption, the petroleum product will only last for the next 40 years. It will be wise for the Federal Government to adopt the policy of 'One-state-one-product' in line with President Obasanjo's earlier policy that fade away. Each state of the federation has relative advantage in the production of one none-oil product or the other. There is the need to resuscitate all the moribund regional manufacturing companies, and give answer to 'Where are the Groundnut and Cocoa pyramids of the first and second republic?

v. Set a target in which all governmental agencies and institutions will have to switch to the use of made in Nigeria vehicles, and be committed to it; while criminalizing vehicle smuggling activities.

vi. Manufacturers and Organised Auto Dealers should be compelled by regulation to train Mechanics/Technicians and thereafter appoint them as Accredited Independent Service Providers (AISP).

vii. Like Nigerian Meteorological Agency (NIMET), the Nigeria Emergency Management Agency (NEMA) in collaboration with the Ministry of Environment should be analysing and disseminating early warning signal on air pollution level across the country.

viii. There is the need to urgently develop a master plan for the implementation of partial and full ITS road infrastructures across the nation in hierarchical order.

ix. The Federal government in conjunction with the states should resuscitate and reposition the 1998 Town Planning Law for effective development control at all levels; while producing georeferenced cadastral maps for effective mobility and spatial interaction planning and management.

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PROFILE OF THE INAUGURAL LECTURER

TPL Jaiye Jehoshaphat Dukiya was born on the 22nd of September, 1964 Kabba, Kogi State, Nigeria, He attended Demonstration Kabba and thereafter proceeded to Oro Grammar School, Oro (where he spend only a year) and later transferred to St. Augustine College, Kabba. He finished his secondary school education in the year 1984 and then got admission in the famous Federal School of Art and Science Ondo for his A level education (where he spend only a year). He then got admission to read Urban and Regional Planning in the University of Nigeria, Enugu Campus, in 1986 where he obtained his BURP in the year 1992.

TPL Professor Dukiya obtained his M.Tech Remote Sensing Applications and Ph.D. Remote Sensing Applications from the Federal University of Technology, Minna in 1998 and 2008 respectively. He is a registered member of the Nigerian Institute of Town Planners.

He joined the service of FUT, Minna in 1998 as lecturer II in the Department of Urban and Regional Planning where he progress steadily from lecturer II to the rank of a professor in 2015. During this period, TPL Professor served tin various offices at the departmental level as student adviser, staff welfare officer, PG coordinator, assistant examination officer, ant school level as school representatives to various schools, School Admission Officer Representative at the University central Admission Committee., School representative in the University Board of Research evaluation, assistant SWEP coordinator, SERVICOM officer, Chairman space allocation officer .At the University level, as Senate representative in the University Physical Planning and Development Committee. (378th Senate meeting), University Committee on Appraisal and Evaluation of Research Proposal. Member University Earn Allowance Distribution committee, Member University Earn Allowance Distribution committee, Member University Committee on Comprehensive Staff and Student Audit for SEET, Member of ASUU committee on the sales of hand-out and departmental student unionism investigation. Member of ASUU committee on staff promotion on publication requirement, Member of committee on Examination Offences and Penalties Review, Member LOC for Nigeria University Research and Development Fair (NURESDEF), and Member University Senate Examination Scrutiny Committee for years.

In the year 2009 when the School of Entrepreneurship and Management Technology was created, he was appointed as the pioneering Head of the Department of Transport Management Technology because of his inclination to transport planning and as the deputy Dean for several years. He has participated in several administrative and research activities within and outside the university. His areas of specializations are Remote Sensing Applications, Transportations Planning, and Environmental Management. And presently he is the Director Centre for Disaster Risk Management and Development Studies.. He has several Journal publications to his credit.

Out the University, he is a Member Think-Tank for Niger State chapter of NITP, Resource Person for FRSC Speed Limit Devices Seminal in Minna, NECO Examination External and a Pastor at Deeper Life Bible Church.

And of cause, he is married to Mrs. Henrietta Buchi Dukiya and are blessed with three children, in persons of Mr. Obed Dukiya, Mr. Jesse Dukiya and Mr. David Dukiya