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Environmental Degradation and Global Warming: The Challenges for Sustainable Transportation in Nigeria

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Abstract: This study looks at the challenges that environmental degradation and global warming pose for the sustainability of our transportation system. The main exhaust gases from transport were discussed. Also, impact of transport on environment were highlighted to include acid deposition, depletion of non-renewable resources, land degradation, climate change, urban degradation, ozone pollution, water scarcity and health hazards. Lastly, appropriate mitigation measures on the impacts of transport on the environment mentioned include reducing the need for travel, using car efficiently, using environmental friendly fuel and alternative transportation.

Key words: Environmental, transportation, gases, degradation, sustainable

INTRODUCTION

The world population was 2.52 billion in the year 1950 which increased to 6.06 billion in 2000 and is likely to reach 5.3 billion by the year 2003 (Bhagat, 2004). Most of the growth in population size is going to occur in less developed countries (UN, 2001), of which Nigeria is one. This situation will lead to increased pressure on the countries' environmental resources. This is because increased population implies increased demand for vehicles and other infrastructural facilities in order for people to satisfy their needs. These human activities result in degradation of the environment and global warming and consequently climate change. With the advent of technology, more people now rely on cars to travel to work, go shopping and to recreational facilities. A phenomenon which leads to increase in greenhouse gas emissions from transport, as traffic delays caused by traffic congestion make vehicles to use more fossil fuels. The wasted fuel does not just mean wasted money, but increased emission of greenhouse gases (LTS, 2002).

The increased atmospheric concentration of these gases gives rise to the "greenhouse effect" whereby a large proportion of the solar energy is trapped by the atmosphere instead of being reflected back into space, hence raising the global temperature. It is obvious that environmental degradation and global warming-results of human activities pose a serious challenge for the sustainability of our transport system, having in mind that sustainable transportation systems are those which, for example, aim to reduce emissions, fossil fuel consumption, the consumption of agricultural land, park land and wildlife habitatat (TEP, N.D).

Therefore, it is very important that all the stakeholders in the transport and environmental sectors put all hands on desk to ensure the sustainability of our transport system. This study aims to look at the challenges that environmental degradation and global warming place on the sustainability of our transportation system, with a view to suggesting the way forward.

MAIN EXHAUST GAS POLLUTANTS FROM VEHICLES

The exhaust gas pollutants from vehicles include Carbon dioxide (CO_2), Carbon Monoxide (CO), Oxides of Nitrogen, Un-burnt Hydrocarbons, Sulphur dioxide and fine particles. Other pollutants include Lead (Pb), Benzene, 1,3-butadiene etc. Table 1 shows greenhouse gas emissions from different forms of transport.

Carbon dioxide (CO_2): Carbon dioxide contributes most to the greenhouse gases effect on climate change. For a given type of fuel the CO_2 emissions of a car are directly proportional to the quantity of fuel use, hence its emission increases with industrialization and the burning

Table 1: Greenhouse gas (GG) emissions from different forms of transport

Forms of transport	Kg of GG/Person/Km
Bike or walking	0.0
Extra person on existing public transport service	0.003
Fuel efficient car, 4 people	0.042
Average car, 4 people	0.08
Large 4WD, 4people	0.11
Fuel efficient car, driver only	0.17
Average car, driver only	0.32
Large 4WD, driver only	0.44

Source: (Travel Samrt, 2006)

of fossil fuels. Carbon dioxide is resident in the atmosphere for an estimated period of between 50-200 years, consequently, having greater long term effects of emission. Fossil fuel burning contributes about 77% of Carbon dioxide that causes greenhouse effects. If measures are not taken to reduce this greenhouse gas, the whole world's weather could change, increasing the frequency and intensity of heat waves, floods, droughts and storms (www.vcacarfueldata.ord.uk).

Carbon Monoxide (CO): Carbon Monoxide is another greenhouse gas that is generated from petrol vehicles and industry. It has been discovered that 98% comes from road transport (Traffford Council, 2007). CO emission unlike CO_2 is not directly link to fuel consumption, rather to vehicle technology and the state of maintenance. CO reduces the blood oxygen carrying capacity which can reduce availability of oxygen to key organs. It poses a health risk to those suffering from heart disease, even at lower concentration (www.vcacarfueldata.ord.uk).

Oxides of Nitrogen (Nox): This is generated from fossil fuel burning (Transport and Industry), biomass and land use changes. Road transport contributes 50% of emissions (Traffford Council, 2007). Oxides of nitrogen react in the atmosphere to form nitrogen dioxide (NO_2). High levels of exposure have been linked with increased hospital admissions due to respiratory problems, while long term exposure may affect lung function and increase response to allergens in sensitive people. NOx contributes to smog formation, acid rain, vegetative damage, ground level ozone formation and can react in the atmosphere to form fine particles.

Unburnt hydrocarbon: This contributes to ozone formation leading to risk of damage to the human respiratory system and they are indirect greenhouse gases.

Fine particles (PM10): They can also be referred to as particulate matter (PM10). They are generated from transport, industry, power generation and natural sources like pollen.

Lead (Pb): This is generated from vehicles that used leaded petrol and industry.

Benzene and 1,3-butadiene: Benzene is generated from petrol vehicles while 1,3-butadiene is generated from all road transport (petrol and diesel).

THE IMPACT OF TRANSPORTATION ON ENVIRONMENTAL DEGRADATION AND GLOBAL WARMING

In the study conducted between 8.00 a.m. and 9.00 a.m. to determine the occupancy rate of vehicles entering and leaving University of Ado-Ekiti, Nigeria (Table 2 and 3), 2 types of vehicles were identified i.e., cars and buses. They were characterized as commercial and private. Commercial vehicles refer to those that convey passengers (students, staff and visitors) in and out of the University for a Price, while private refers to those vehicles own by individuals. It was discovered in the study that single occupancy cars and buses (commercial) leaving the campus was about 64 and 52.44%, respectively of the total vehicles and for private cars and buses about 60 and 50%, respectively.

The study shows clearly that a lot of people travel alone in their vehicles, a phenomenon that contributes to the emission of gases and pollution of the environment. Some of the negative impacts of these pollutants are highlighted.

Acid deposition: The emission of acid gases like NO_2, SO_2, produces acid rain. This results in acidification of soils and water and consequently damage of human health,

Table 2: Occupancy rate of cars entering and leaving University of Ado-Ekiti, Nigeria

Car Characteristics	No of Passengers	No of incoming cars	% of incoming cars	No of outgoing cars	% of outgoing cars
Commercial	1	-	-	16	64.00
	2	-	-	2	8.00
	3	3	7.14	3	12.00
	4	2	4.76	3	12.00
	5	5	11.90	1	4.00
	6	11	26.19	-	-
	7	20	47.62	-	-
	8	-	-	-	-
	9	1	2.38	-	-
Private	1	35	18.72	27	60.00
	2	60	32.09	10	22.22
	3	27	14.44	2	4.44
	4	29	15.51	2	4.44
	5	28	14.97	1	2.22
	6	8	4.28	1	2.22
	7	-	-	2	4.44

Table 3: Occupancy rate of buses entering and leaving University of Ado-Ekiti, Nigeria

Bus Characteristics	No of Passengers	No of incoming buses	% of incoming buses	No of outgoing buses	% of outgoing buses
Commercial	1	1	0.33	118	52.44
	2	-	-	45	20.00
	3	2	0.66	20	8.89
	4-7	43	14.24	35	15.56
	8-11	229	75.83	7	3.11
	12-15	18	5.96	-	-
	16-19	9	2.93	-	-
Private	1	3	21.43	2	50.00
	2	2	14.29	1	25.00
	3	1	7.14	-	-
	4-7	2	14.19	2	25.00
	8-11	-	-	-	-
	12-15	1	7.14	-	-
	16-19	5	36.71	-	-

Table 4: Land degradation by region

Region	Degraded area (DA) million hectares	DA as percentage of vegetated land
World	1215.4	10.5
Europe	158.3	16.7
Africa	320.6	14.4
Asia	452.5	12.0
Oceania	6.2	0.8
North America	78.7	0.4
Central America and Mexico	60.9	24.1
South America	138.5	8.0

Source: (WRI, 1990)

Table 5: Periodic road traffic accident rates for Nigeria

	Severity rate per 100 RTA	
Period	Killed	Injured
1960-1969	13	70
1970-1979	22	72
1980-1989	32	89
1990-1999	41	111
2000-2004	49	114

Source: (Yerima and Egwurube, 2006)

forests, crops and buildings, decline in fish, etc. Trends for global emissions of the principal acid gases sulphur dioxide and nitrogen oxide are difficult to access. Air pollution is on the increase in rapidly industrializing countries.

Depletion of Non-renewable resources: Overdependence on non renewable energy like fossil fuels is driving us towards unsustainability, as the sources become depleted over time, thus compromising the ability of future generations to meet their own needs.

Land degradation: Since 1972, farmers have lost nearly 500 billion of top soil (Brown *et al*., 2003), a process that continues at a rate of 24 billion tons a year (Paul and Michael, 1995). This reduces their harvest and causes food insecurity (scarcity). Although, the major activities leading to land degradation are deforestation, overgrazing and agriculture, land degradation is also caused by wind and water erosion and by chemical or physical factor, the former including salinization, acidification and pollution, the latter including compaction and water logging. As reported by (Paul and Michael, 1995), Table 4 shows how moderate, severe and extreme land degradation affects regions.

Climate change: Climate change causes environmental treat to the world, changing the weather pattern. This result in warmer environment, wetter winter, increased flooding and drought, all of which impact on us negatively.

Urban degradation: Increasing road network-a means of checking traffic congestion impact on our landscape leads to urban sprawl and decline in quality of urban living, not to mention appalling annual statistics of road injuries and death. Table 5 shows the periodic road traffic accident rates for Nigeria.

Ozone pollution: This is an invisible pollutant caused mainly by automobile exhaust. It is formed from the action of sunlight on volatile organic compounds and Nitrogen oxides emissions from engines, power plant and other pollutant (TMG, 2003). Ground level ozone causes problems for asthmatics, those with lung conditions etc. Destruction of upper atmosphere ozone-naturally occurring compound that protect us from the sun's harmful rays by chemical emissions is also a problem causing global warming.

Water scarcity: Water is essential to life and it is expected that it should be available in required quantity for peoples' use. Today, many nations are being confronted with scarcity of water, which is as a result of drought caused by global warming. It has been discovered that in Beijing-Capital city of China, water tables have been falling 1-2 m $year^{-1}$ and a third of the wells have run dry, yet its total water demand in the year

2000 is projected to outstrip its current supply by 70% (Brown *et al*., 2003). The country of the Middle East and North Africa face a situation of particular difficulty (Paul and Michael, 1995).

Health hazards: The greenhouse gases have adverse effects on human health. This is more pronounced among people with respiratory problems, young and elderly people.

STRATEGIES TOWARDS REDUCING/AVOIDING TRANSPORT ACTIVITIES CONTRIBUTING TO ENVIRONMENTAL DEGRADATION AND GLOBAL WARMING

Appropriate mitigation measures to reduce/avoid transport activities that impact negatively on the environment and the inhabitants are discussed. Some of them require that we make sacrifices, which I believe are not too much, bearing in mind the negative impacts of the activities.

Travel less: Since, the need to travel is the major reason why people use vehicles, an attempt at reducing travel will go a long way in putting our transportation system on a sustainable path. Each kilometer of car travel avoided saves up to half a kilogram of greenhouse gas and 20% in operating cost (Travel Samrt, 2006). Also, every liter of petrol saved cuts greenhouse gas emissions by 2.8 kg and saves you at least one US dollar plus vehicle wear-and-tear (Travel Samrt, 2006). It is therefore essential that we plan all trips to do several things on each trip.

Use car efficiently to safe energy: The various way of using car to reduce greenhouse gas emissions have been highlighted (UN, 2001; Travel Samrt, 2006).

- Plan ahead: Planning your journey ahead ensures that you combine trips, choose uncongested routes, etc.
- Drive smoothly and efficiently and avoid stop-start traffic: Driving more smoothly saves fuel, as harsh acceleration and heavy breaking have a very significant effect on fuel consumption and save up to 30% of greenhouse gas emissions.
- Ensure tyres are pumped up to maximum recommended pressure so that they roll more easily. This saves up to 100 kg of greenhouse gas each year, extend tyre life and improve safety.
- Remove unnecessary weight from your car. Fifty kilogram less weight cuts greenhouse gas emissions by almost 2%.
- Use higher gears, as soon as traffic conditions allow.
- Switch off the engine whenever it is safe to do so.
- Regular servicing helps keep the engine at best efficiency
- Use air-conditioning (AC) sparingly: Running AC continuously will increase fuel consumption significantly.

Use environmentally friendly fuel: Different fuels have different merits from an environmental perspective (www.vcacarfueldata.ord.uk). Switching to cleaner fuels will reduce the emission of greenhouse gases. For instance diesel vehicles have significantly lower CO_2, CO and HC emissions per kilometer traveled, because of the higher efficiency of diesel engines, however, they emit greater levels of NOx and particle that petrol vehicles. LPG vehicles fall between petrol and diesel in CO_2 performance. CNG offers lower CO_2 emissions than LPG, typically comparable with diesel. Hybrid vehicles offer reduced fuel consumption and CO_2 with potentially some reduction in emissions of local pollutants (CO, HC, NOx and Particles) (www.vcacarfueldata.ord.uk).

Alternative transportation: This simply means something other than driving your car-Single Occupancy Vehicle (SOV), which is the major cause of traffic congestion (TMG, 2003). The forms of alternative transportation include bicycles, walking, ride-sharing, teleworking and flextime. All these go a long way in reducing the number of vehicles on our roads and subsequently the greenhouse gas emission.

CONCLUSION

It has been established in this study that our transportation system plays a part in environmental degradation and global warming, which impact negatively on healthy living. It is therefore, necessary that we start evolving strategies to put our transport system on sustainable path. This will guarantee a safer environment through the reduction of emission of greenhouse gases and other pollutants.

Therefore, it is very important that all and sundry be prepared to sacrifice our individual mobility and accept public transport and other measures that will ensure a decrease in transport activities that contribute to environmental degradation and global warming.

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