Automotive industry: designing for the environment

Business

There is no doubt the automobiles have changed the world in various facets.

In the 21st century, the use of automobiles has increased with the demand of vehicle of different kinds. Indeed, the manufacturing of automobiles has been of the enormous impact to the human society. However, the use of automobiles has brought impact on the environment, which forms one of the negative impacts of automobile manufacture. Environmental impact still remains one of the areas that raise concern about automobiles even as vehicles and trucks allow greater mobility, both for goods or people. The continued use of automobiles in society is attributed to the degradation of the environment as more people automobiles are produced and used across the world. The motivation behind the green technologies can be connected to the impact of automobiles on the environment.

The pushes for greener technologies come when the world is experiencing high levels of environmental pollution. The increased number of pollution has been connected to the increased levels of the greenhouse effect, and global warming. The impact of environmental changes has been regarded has extensive and touching on various areas such as melting of ice in Polar Regions and global warming. The impacts on the environments have been attributed to many factors with the automobile industry being the most responsible. There are many areas of the automobile industry that are connected to the increase negative impact on the environment. The increased awareness on the impact of automobiles has resulted in the rise of greener technologies that are being adopted in the manufacturing of automobiles.

This move has gained momentum as more consumers demand automobiles that have less impact on the environment. Most important, use of legislation to promote green technologies in the automobiles industry cannot be underestimated. Many countries are awakening to the fact that automobiles have a greater impact on the environment compared to other variables. The creation of legislative measures underscores the importance of laws in ensuring the automobile industry take appropriate actions towards promoting a better environment for automobiles are not regarded as agents of environmental destructions. In the light of automobiles and their impact of the environments, this paper will look at the effects of automobiles on the environment, and analyze how manufacturers create sustainable designs.

The paper will also address the use of legislation that has been enforced on automobile manufacturers in order for them to produce automobiles that have less impact on the environment. Effects of automobiles on the environment The interaction between automobiles and the environment is wide and varied. The automobiles cover wide areas, each having a considerate amount of influence on the environment. The impacts of the automobiles are a result of intersection of various areas that are identified below. a) Automobile and air pollution The automobiles are responsible of the largest share of emissions in the world today.

The number of emissions in the atmosphere is said to be increasing a result of automobiles production process as well as their use. With the use of automobiles as the preferred mode of transport, the number of emissions is higher in the atmosphere as before. Automobiles rely on fuels that are

burned in the engine to provide energy that powers engines used in automobiles. While fuel use is critical to the success of the automobiles, its combustion is attributed to the generation of combustion gases that have a negative effect on the environment. The emission resulting from the use of automobiles can be grouped into three different classes: evaporative emissions, refueling losses and exhaust emissions. i) Emission from the combustion process Automobiles often use gasoline and diesel fuels which are composed of hydrocarbon compound that have hydrogen and carbon atoms.

In a theoretical environment, it is postulated that an engine would convert all fuel into non-harmful emissions. However, this is not the case as perfect engine do not exist. Instead, the combustion process of automobiles engine produce gases that pollute the environment in various ways. The exhaust pollutants, which damage the environment, are hydrocarbons, carbon monoxide, carbon dioxide and nitrogen oxide. Combustion processes of automobiles are responsible for increased levels of hydrocarbons in the atmosphere.

When automobiles engine burn fuels that are injected into them, a certain percentage of the fuel remain unused. The resulting emission will be made chiefly of hydrocarbons, which can react with nitrogen oxides in the presence of sunlight. The result of this reaction will be the formation of ground-level ozone, which is mainly attributed to smog. The impact of smog is not related to reduction of visibility alone, but it is also linked to various diseases as well

as body harm. For instance, exhaust hydrocarbons can cause toxic matter that can lead to cancer in humans.

Automobiles combustion process can produce exhausts that contain nitrogen oxides. During the combustion process, nitrogen and oxygen become fused to form nitrogen oxides. This process takes place because of the high temperature and pressure found in the engines of vehicles. Nitrogen oxides are similar to hydrocarbons since they are associated with the formation of ozone’s. The presence of ozone’s irritates the eyes. The presence of nitrogen oxides in the air is attributed to the formation of acid rain that has a significant impact on the environment.

Apart from wearing property such as house and equipment, acid rain can damage vegetation as well as soil that are sensitive to varying levels of acids. For example, limestone’s can be destroyed due to acid rains. Carbon monoxide is another product formed due to incomplete combustion in automobiles. During the combustion process, fuel can be burned partially and carbon partially oxidized to form carbon monoxide, which is a pollutant. The resulting Carbon monoxide can cause significant impact on human life as it has the potential of inhibiting the flow of oxygen in the blood stream. In addition, it can cause the heart diseases in humans.

Carbon dioxide is another emission product formed during the combustion process. Carbon dioxide has been regarded as one of the most dangerous gases. Recently, The Environmental Protect Agency classified the carbon dioxides as a greenhouse gas. This is because the gas is related to the rise of global warming, which is connected to the ability of the gas to trap heat

within the atmosphere. Though carbon dioxide is among the many gases that contribute to the rise of global warming, the impact of this phenomenon has a far reaching effect on the environment.

Some researchers link the increased level of melting ice in Polar Regions to global rise in temperature caused by global warming. ii) Evaporation from automobiles can also cause gaseous emissions, which have the potential of affecting the environment. When automobiles are fueled, there are chances that some of them escape into the environment where they build up and interfere with it. During refueling process in a hot day, automobiles can also lose a considerable amount of fuel through the evaporation process. The impact of this evaporation stems from the dangers of fuels in the atmosphere that can be ignited to cause fire. Fire from automobiles is a serious threat that has accounted for a considerable number of accidental fires.

iii) Apart from the above emission, automobiles are responsible for emitting volatile organic compound and particulate matter. Friedrich and Reis (2004) argued that automobiles produce volatile organic compounds that take part in the formation of ozone. Formation of ozone is possible because volatile organic gases often take part in various photochemical reactions. In some cases, volatile organic compounds are known to take part in the formation of ground-level ozone that can lead to smog. This type of ozone can damage the environment by harming plants. On the other hand, particulate matter can be formed by vehicles when fuel is burnt.

Particulate matter consists of solids that make smoke and smog, and can be deposited on leaves of plant and causes them to die or wither. In addition, particulate matter affects humans in because they can cause irritation. b) Automobile and water pollution Automobiles have a negative impact on the water sources on the earth. Automobiles are believed damage ground water in areas such as lakes, creeks, rivers and other reservoirs. Automobiles can deposit oil, dirt and other automobiles fluid; can be washed when it rains. The impact of such runoff can result in the introduction of pollutant into water sources.

The impact of contaminated runoff is complex, but it touches on reduced quality of water, and introduction of other chemical that can affect the environment in other ways. The increased levels of water pollution can be attributed to automobiles pollutant to a smaller extent (Hoonrbeek, 2011). With water pollutant, the number of clean sources is likely to be reduced. Moreover, polluted water sources in areas such as rivers and lakes can cause fatal impact on marine life. Polluted rivers can cause death of fish and other sea plants. Though caused by oil spill, the water in the Gulf of Mexico experience a pollution of a higher magnitude never witnessed before.

The impact of this event is an example of how automobile fuel can damage the environment. c) Automotive fluids Automotive fluids can cause significant harm on the environment. Automobiles make use of various fluids, which must be handled appropriately and disposed after they are used. When automobiles fluids are poorly handled, there is a risk of them polluting the environment. For instance, most engine oils are often replaced,

but they must be carefully disposed to avoid polluting the environment (Hills, 2009). However, there are cases when oil is spilled on the ground.

When cleaning is not done, these oils pollute water bodies making them impure, as well as endangering marine life in water. Leakage of fuel tanks and automobiles engine is also primary causes of spills of engine oil, fuel and other liquid like brake fluids. These liquids have a significant impact on the environment. The impact of these fluids is significant considering the fact that most of them are dumped illegally and some left in landfill. With these liquids in these areas, underground water sources can be affected bring a negative impact on the entire environment.

d) Automobile and solid waste Automobiles are the most significant contributor of solid waste in the entire world (Hoornbeek, 2011). When automobiles are old and worn out, most of them are recycled and used in landfills thus increasing environmental waste. Other parts of vehicles such as tires are also destroyed and placed in dump sites along other parts. The impact of this waste is a significant risk to the environment as more recycled care fill dump sites across the world. As a result of recycling of automobiles, more land is needed to provide more landfills.

Constant fires and decays in the landfill can lead to emission of toxic gases that can cause more pollution of the environment. For example, the decay of rubber material or their burning can release harmful gases into the environment. The impact of these gases can be felt in the prodction of acid rains that can cause erosion of property and limestone. e) Production of automobiles Production of automobiles and their parts forms one of the most

significant causes of environmental pollution. During the production of automobiles, there are many resources that are used to make various parts of the automobiles. Most of the resources are mined and processed to yield more refined parts.

For instance, many automobile parts are made from metal parts that are made in factories that mine and produce different metals. In addition, the recycling of vehicles is another process that consumes fuels and lead to the environmental degradation. Even when a few lead being dumped come from automobiles, this value is still considered as n significant cause of pollution. The dumping of lead-acid batteries form part of pollution because lead is a crucial contaminator of water sources. The production of automobile production has many activities that require resources, with many of them being non-renewable. The overall result of the whole process is the production of pollutants that affect the environment in various ways.

f) Automobiles and sound pollutions Automobiles are responsible for sound pollution, a category of environmental effect that causes distraction and irritation to humans, as well as wildlife. The use of automobile in the transport sectors contributes to increased levels of sound in the environment, which cause disturbance to the environment. The impact of noise pollution can be felt by humans and wildlife close to the source of noise. For example, humans living or animals living next to transport highways can experience high levels of sound that can inhibit their natural processes and interaction. g) Energy and resource shortage The environment is continually being degraded because of the growing demand of fuel for

automobiles. Most of the automobiles are non-renewable because they are used and cannot be recycled once they are used.

Fuels such as oil are extracted though the thrilling of underground rock to reach oil reserves. Whereas exploration of oil is justified, drilling of soils result in environmental disturbance and possible pollution. In addition, petroleum use has resulted in increased use of crude oils, which must be processed. The danger of processing more crude oils is connected to increased levels of air pollution in the environment. The impact of this process is depicted in increased levels of emission of gases during the production of fuels.

In the long run, the impact of automobile production and reliance on natural resource cause their shortage. Apart from this, the use of raw material such as iron or aluminum fuel more mining that cause degradation of the environment. Analysis of how vehicle manufacturers create sustainable designs There are many motivations behind the development of automobiles that are eco-friendly. Whereas the increase in consumption of fuels is one of the reasons, the impact of automobiles on the environment remains that chief factor why many manufacturers are going green. The introduction of green design by automobile manufacturers underscores the value of adapting to the environmental degradation.

This adaptation is made possible through the production of automobiles that employ various strategies to remain green. Eco-design is often known as clean design as it allows manufacturers to design automobiles that are friendly to the environment when used during the entire lifecycle. The

production of green cars follows a number of design goals, with the main one being the reduction in the environmental impact of automobiles. Sustainable design lies at the core of the green initiatives where manufacturers are focusing on how to increase the lifecycle of materials used in the manufacturer of automobiles with the intent of economic and environmental concern. Designing for the environment is a concept that calls for the manufacture of automobiles that have less impact to the environment from production for the consumption period. This concept has also being modified to include the recycling phase of automobile where the goal still remains as reducing the impact on the environment.

The success of the eco-design rests in the production of automobiles by balancing the need of environmental protection and that of building automobiles that cost less, but have improved security and quality. Whereas this process is still challenging, many manufacturers, the value of producing green vehicles cannot be underestimated. Instead, more automobile manufacturing companies increasingly adopting their strategies to incorporate elements of green technologies. There are many drivers for global adoption of eco-design in automobile manufacturing process. These drivers include scarcity of energy, increase of regulations, climate change, public safety, and resource constraints. The majority of eco-designs focus on the proper selection of material in the manufacture of automobiles in order to produce end products that have less impact on the environment.

Eco-design has many approaches that are aimed at reducing the impact of vehicle in the environment. Approaches are varied but reducing the weight

of vehicles forms the most commonly used approach to manufacture efficient automobiles. Material selection as materials There are many opportunities that regarded as fueling the adoption of weigh reduction of automobiles. This opportunity is consistent with the reduction of the use of healthy metals in the automobile manufacturing process. In the automobile industry, the use of steel related structures has been cut down as more manufacturers prefer to use plastics to produce various body parts. In return, eco-design approaches have caused the increase in the number of plastics other composite materials that are being used in the manufacture of automobiles as well as other lightweight metals (Quinn, 2010).

The design of environment has also spurred the rise of reduced toxicity in vehicles as well as increased recyclability of automobiles after their life cycle. During the manufacture of eco-friendly cares, several materials such as aluminum, titanium, magnesium and glass are used to produce automobiles that have been designed for the environment. These materials have various properties that make them unique in different ways. This is the basis of selection for use in the making of green design in modern automobiles. Many automobile manufacturers have focused their approach on reducing weight as a means of creating sustainable designs in vehicles. This is done on various areas of automobiles through appropriate selection of materials (Ashby, 2010).

Automobiles areas where manufacturers reduce weight are the body, chassis, powertrain, and fuel use. Automobiles chassis and body parts are two areas where significant weight reductions can be achieved. In the

production of automobiles, many manufacturers concentrate on these areas in order to achieve greater weight cut as compared to other areas. When designing the body, many manufacturers tend to exploit other materials that are lighter as compared to steel, which is the common material used in making the chassis. With an aim of producing chassis with the least weight, automobiles manufacturers concentrate on using design optimization approaches the aim at reducing weight in all aspects while ensuring that automobiles are lighter and thus able to reduce their emissions on the environment. Most important, many automobile manufacturers are increasingly using unibody construction technique where small pieces are used to make large automobile parts.

Even when this process produces cars that are difficult to repair and manufacturer, the process is touted to be cheaper and useful in the creating of light body parts. The technique of using unibody is currently being exploited by manufacturers ofFordEscape and assorted Mazda vehicles. The main hurdle facing automobile manufactures has been their reliance on steel frames for the production of steel chassis. Despite the strength, that steel has, this component is attributed to more weight increase that makes vehicles consume more fuel and thereby causing more impact on the environment.

However, there a number of alternatives that can be used to make steel frames for use in building automobiles. Titanium is one of the parts that are light and strong thought it is too expensive to recycle (Spiro & Stigliani, 2003). Magnesium alloy is another material that can substitute steel because

it is lighter though it has little corrosion resistant properties. Aluminum is considered as one of the best alternative for use in the manufacturer of body parts. Automobiles such as Acura NSX and Audi A-8 use aluminum to make body suspension and chassis.

When manufacturers employ the use of aluminum, most of them reduce the weight of the body parts by replacing about 80% of steel used in the manufacture of automobile. When automobile manufacturers reduce the amount of steel in vehicles, most of them achieve significant weight cut of about 260 kg. The most intriguing cut is made on cost used to operate the automobiles. When reducing the weight of body parts, it is believed that 10% reductions constitute to 6% increase in the level of fuel efficiency. This is a huge saving that allows manufacturers to save a lot of money in fuel used to operate automobiles.

The impact of reduced fuels also translates to less usage of fuel, which implies that these automobiles will produce fewer amounts of emissions. The overall impact of such vehicles is thus less as compared to those that consume a lot of energy. The use of aluminum in the making chassis is a significant design strategy that reduces the amount of weight in vehicles. Apart from other body parts, automobile manufactures have use composites, plastics and aluminum to make automobile body parts that allow reduction of weight. The use of composites offers better weight reduction, although the process is costly and the makes recycling process difficult.

The use of composites can be found in racing cars such as the McLaren F1, which is very light and stiff. Apart from the composites, aluminum can also

be used to reduce the amount of weight in automobile body parts. With the use of aluminum, it is possible to produce body parts that are consistent though they are costly to repair. Plastic panels are increasingly being used to manufacture body parts that are resistant to damages such as abrasion. The use of plastics to make automobile reduces the painting process. The impact of eliminating this steps translates to the reduced amount of emission from paints that my contain lead.

In cases where thermoplastics are used, the automobiles produced will be better recycled thus allowing less impact on the environment as waste. The use of plastics in the production of automobiles body part translates to significant weight reduction in vehicles. The positive aspect of plastic is also its ability to reduce the amount of fuel that can be used to power vehicles. The overall benefit of plastics is, therefore, reduction on fuel demand from automobiles. Engine design is another approach that automobile manufacturers use to achieve a design that is suitable for the environment. When designing engines, there are several areas where engineers concentrate on.

These areas include reduction of weight, fuel consumption, low exhaust, and sound insulation. The engine has several parts that have unique functions, and are used as the basis for the reduction of weight in automobiles. The engine block serves as the foundation of the engine. This is part of the enginne can be engineered to produce meaningful reduction in weight by switching from the use of cast iron or steel. The transition from steel to aluminum raises a number of concerns, but use of strong casting techniques

strengthens aluminum making them be perfect contenders for producing automobiles engines that are eco-friendly.

Many automobiles such as the Honda Accord, ToyotaCamry and Oldsmobile make use of Aluminum to produce engines blocks, thus, reducing the amount of energy spent on moving the automobiles. Significant savings can also be achieved when plastics are used to make manifolds that are use guiding air into automobile engines. In the automobiles design, air intake is a major criterion that influences engine performance. Through the use of plastics, it is believed that a significant contribution can be realized when producing the engines.

In addition, the use of plastic is believed to improve engine performance because of their ability to allow smooth air into engine. The lower thermal conductivity of plastic is another factor that make then suitable for use in the manufacture of engine manifold do not absorb heat during warming. The impact, of using plastic is, therefore, beneficial in improving fuel use in automobiles. Fuel tanks are also an area where automobile manufacturers concentrate in designing automobiles that eco-friendly. Manufacturers are increasingly producing tanks of vehicles that are chemically resistant, and can withstand high pressures.

Many legacy vehicles use steel in the manufacture of steel tanks. However, steel is heavy and can be weakened by erosion. In order to reduce the efficiency of tanks, plastic and other composites are used to providing lightweight alternatives. In making tanks, some automobiles manufacturers are replacing steel tanks with those made of polypropylene, which has better

features in terms of weight reduction. Apart from this feature, tanks made from polypropylene are known to have increased resistance to fuels. Because of this, their use reduces incident of fuel spills that can lead to environmental pollution.

Better designs have increased designing automobiles for the environment. Legislation being enforced on vehicle manufacturers As the use, of automobiles cannot be done away with, there are various legislations that have been enforced on the vehicle manufacturers. This legislation is meant to enable manufacturers to come up with sustainable designs of automobiles that have fewer effects on the environment. This is as a result of the consumers, multinationals, governments and environmentalists who have had the skeptical interest in the impact of automobile use on various aspects that affect their daily lives. Their vested interests are due to them becoming further aware of the relationship between their procuring varieties of motor vehicles that do not have extensive effects on the environment. They also considered their mode of using the motor vehicles as a way of transport in order not to have a lot of influence on the environment.

They, therefore, were generally concerned with the subsequent impacts both on the environment and on the extensive society. As governments, predominantly Europe appreciates the adverse influence of the automobile use on the environment. It is intervening with new legislations that will put an end to the effects of automobile use today. This is through putting a disposable responsibility on the manufacturer of the automobile with the legislations throughout the manufacturing process. The End of Life Vehicles

is one of the current approaches introduced with the impending European Union legislations to force responsibility back to the manufacturers through a range of measures.

Bhamra and Hon describes these measures to consist of creation of vehicle depollution stations, official logging of the production, sale and disposal of each car and enforced materials composition limits in order to aid recycling and reduce the landfill’s effect. Legislations on development of vehicle depollution stations Legislations of the European Union member states are meant to oversee manufacturers come up with vehicle depollution stations. Indeed, the main objective of implementing the legislations is to come up with an efficient system. This system ensures that a car is being taken through a thorough procedure to identify hazardous components existing within the body of the vehicle. The procedure undergoes various steps in trying to identify areas with defects in the vehicle.

This is through use of metal, and other components are recycled, and thereafter, manufacturers carry out responsible disposal to minimize environmental pollution. Indeed, the companies that perform vehicle depollution ensure that vehicles become environmentally friendly. Legislations on recycling, reuse and extension of automobile life The European Union main goal is to oversee, the choice of recycling, reuse and extension of automobile life earns more consideration by manufacturers as they assemble vehicles. Automobile manufacturers have to therefore, comply with the regulations and come up with recycling methods that will significantly reduce disposal of hazardous waste that is becoming

unaffordable today due to the effects it poses to the environment. A less-toxic alternative process that will come up with recycling of the metals that are depleted is therefore, necessary.

According to, the European Union expects that the reuse and recovery rates rise from 85% and 80% in the year 2006 up to 95% and 85% respectively. Failure of the manufacturing companies to comply with the regulations could lead to further legal default charges. As a result, there will be a significant cost impact on the metals required for use by manufacturers as there will be recycling and re-use of the materials that have already been used. This will enable manufacturers to save on the materials they are required to use as they can reuse old scraps metals. Eventually, the metal that cannot be used is entirely disposed of safely. This will also profoundly contribute to the environment preservation as the cases of land refill that arise due to disposal of metals before depletion is extensively reduced.

Legislations on sale and disposal of automobilesThe European Union has put down legislations to deal with the sale and disposal of vehicles in within the European Union member states. The automobile manufacturers are expected to set a date for collection of vehicles that were manufactured before the year 2002 and thereafter those before the year 2003. This was an act of ensuring that the manufacturers can have back vehicles that were made up of heavy metal. These vehicles were later expected to be recycled by the manufacturers and the metal finally re-used for the manufacture of new models of vehicles. This regulation is not easy to implement because car owners could not accept to give the manufacturing companies their vehicles.

In return, the car owner would prefer to sell the vehicle to another buyer to re-use. This eventually led to old depleted vehicles being left to rust. The European Commission, therefore, saw the only way was to ask the manufacturers to breach the cost and repossess the vehicles in order to reuse the metal. Legislations on air pollution and Emissions Legislation has been imposed on the emissions that the vehicles produce when in use. According to the United States Clean Air Act section 303 that was implemented in a bid to reduce emissions from motor vehicles by charging liability to the manufacturer.

This is to ensure that the manufacturers come up with properly designed automobiles that are suitable for use without emitting hazardous fumes. Indeed, under the United States emission regulations act it was set up to make manufacturers come up with raw materials that are less hazardous. The emissions of a lot of carbon dioxide and hydrocarbons remarkably were believed to cause environmental pollution. As a matter of fact, an individual needs to understand that the emissions produced to arise from functions of a number of parameters. These parameters include the after-exhaust treatment technology, engine, the quality of the fuel being used and the driving cycles. As stringent emission standards are being put into place for the production of downscale engines there, is an expectation of tremendous prominent trends in the use of such engines in the automotive industry.

As a result, of looking forward to the emissions norms as EURO 5, the ACEA agreement and EURO 6, car makers for measures, they can undertake to meet the legislations. According to EURO 5 and EURO 6 regulations act it

covers the vehicles levels of emission as it sets out emission limits for the different types of vehicles. As a result, the manufacturers are expected to check the anti-pollution devices that they use carbon dioxide emissions and measure the engine power. In addition, manufacturers are expected to come up with easy and clear access to information that involves vehicle repair and maintenance. Through this information, being availed to the independent operators they will have restrictions free, and standardized information while carrying out repairs and upkeep of the vehicles. Legislations on Vehicles manufactured Legislation requires the vehicle manufacturers to identify the number and types of vehicles in the vehicle stock that are likely to contribute extensively to air pollution.

London Low Emissions zones have come up with restrictions to reduce exhaust pollution. The new restrictions cover motor vehicles, and the larger vehicles that will have to meet the Euro-4 emissions limits. These restrictions are meant to regulate the exhaust emissions of mainly new vehicles sold within the European Union members of states. The restrictions cover different models of vehicles ranging from their sizes and the type of fuel they use between petrol and diesel. Legislation on minimization of waste disposal The European Union legislations gears to minimize waste disposal this is through the reduction of the hazardous elements that encourage reuse, recycling and recovery.

According to Christensen the waste minimization process does not entail processes to change the physical, chemical or biological composition of waste disposal so as to treat water. This is only achievable through waste

preventions where the vehicles are identified at source before disposal. The European Union commission has notably come up with regulations to enlighten proper disposal of materials used to make up the vehicles. The automotive glass manufacturer’s invention of recyclable glass is a major boost to automobile manufacturers in Europe. The manufacturers are following the regulations on the requirements of the directives on end-of-life vehicles.

Conclusion In conclusion, there is no doubt that automobiles have caused significant impact on our environment. Through emissions, fluids and other automotive waste, automobiles continue to cause significant impact on the environment through pollution and putting pressure on energy resources. However, manufacturers employ various strategies to design cars that are eco-friendly. By reducing weight of automobiles, it possible for manufacturers to use green approaches to reduce energy demands. These approaches have further being reinforced by legislation that have placed restriction on exhausts discharge, emissions levels and recycling of automobile components.

Certainly, there more is required to adapt automobile to the environment.