ASSESSMENT OF ENVIRONMENTAL AND PUBLIC HEALTH IMPACT OF AUTOMOBILE WASTES IN ILORIN KWARA STATE

BY

ADEBAYO SIMEON ANUOLUWA

2016/1/62000TI

DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION
FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

APRIL 2023.

ASSESSMENT OF ENVIRONMENTAL AND PUBLIC HEALTH IMPACT OF AUTOMOBILE WASTES IN ILORIN KWARA STATE

BY

ADEBAYO SIMEON ANUOLUWA
2016/1/62000TI

A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION, FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, NIGER STATE

DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION
FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

APRIL 2023.

DECLARATION

I, ADEBAYO SIMEON ANUOLUWA, hereby declare that this project work titled "Assessment of environmental and public health impact of automobile wastes in Ilorin Kwara state" has been written by me and is a record of my original research work that it has not been presented partially or wholly for any other qualification anywhere. Information and quotation from other sources (published or unpublished) have been duly acknowledged by the means of references.

…….

ADEBAYO SIMEON ANUOLUWA SIGNATURE AND DATE
2016/1/62000TI

CERTIFICATION

This is to certify that this research Project titled, "Assessment of environmental and public health impact of automobile wastes in Ilorin Kwara state" was carried out by ADEBAYO SIMEON ANUOLUWA. (2016/1/62000TI) meets the regulations governing the award of the degree of Bachelor of Technology (B. Tech) in the Industrial Technology with Automobile option in the department of Industrial Technology, School of Sciences and Technology Education, Federal University of Technology Minna, and it is approved for its contribution of knowledge and literary presentation.

……...

MRS. FRANCA C. NWANKWO — Signature & Date
Project supervisor

……...

DR. T. M. SABA — Signature & Date
Head of Department

……... ……..

EXTERNAL EXAMINER — Signature & Date

DEDICATION

This research work is dedicated to the Supreme God who strengthened and saw me through the course of my study in the university.

ACKNOWLEDGEMENT

My deepest gratitude goes to the Supreme Being, my source of strength, inspiration and sustenance, whose unending love and grace has brought me this far. I would like to thank and appreciate the immense support of my supervisor Mrs. Franca C. Nwankwo, who worked hard to make this project a success. My thanks also go to my HOD, Dr. T. M. Saba, and the research project coordinator Dr. A. M. Hassan. I am sincerely grateful to all the lecturers at the Department of Industrial and Technology Education, including Prof. B.N Atsumbe, Prof. R. Okwori, Prof. E. Raymond, Prof. A.M Idris, Prof. I.Y Umar, Dr. G.A Usman, Dr. A.M Hassan, Dr. Abdulkadir Mohammed, Dr. S.A. Owoduuni, Dr. C.O Igwe, Mallam S.A Musa, Dr. Dauda Ibrahim, Dr. A.B Kagara, Dr. I.K Kalat and Mr. Abutu Francis, for their support and guidance. My sincerest thanks go to my parents, Mr. and Mrs. John Adebayo, for their support throughout my stay in the university and my siblings, Joel Adebayo and Comfort Adebayo, for believing in me. I would also like to express my appreciation to my friends David Adeleleke, Abee Isaac, Ajibade Abass, Emmanuel Olatunde, Joseph Tsado, Obed Kolo and all my course mates, for standing by me.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Due to poverty and the awful need to own vehicles for ease of movement, aging vehicles still attract customers from Ilorin's middle class and those at the lower tread of the economy. Large numbers are taken to automobile workshop for repair and refurbishing. Thus, waste from the production and use of these vehicles can greatly impact public health. This leads to the assessment of environmental and public health impact of automobile wastes in Ilorin Kwara state. This study adopts the survey design approach. The study collected primary data with the use of online questionnaires. A sample of 74 people living in Ilorin was purposively selected for the purpose of the study. Data collected include socio-economic information of respondents, types, sources, environmental and health risks associated with automobile wastes in Ilorin, potential solutions and technologies for managing automobile waste (disposal practices). Descriptive and inferential statistical tools were used to analyze data from field work. Charts, Weighted Mean Score (WMS) and relative importance index RII were used to represent and analyze data. Analysis of the study was done with the aid of the Statistical Package for Social Sciences (SPSS) version 23. The results of the study indicate that the active population in the youth age group is mostly educated to tertiary level and has a low level of experience in automobile usage. In regards to the types of automobile waste in Kwara state, most respondents were undecided, however they were certain that used oil, fuel, and other hazardous materials were disposed of improperly. Additionally, scrap yards were observed to be a major source of automobile wastes in Ilorin. Most respondents were aware of the environmental and health risks posed by these materials and agreed that measures should be taken to address them. Recycling and automation were the most preferred solutions for managing these wastes, while the donation of automotive waste to charities and local workshops, as well as the introduction of eco-friendly vehicles, were also considered viable options

CHAPTER ONE

INTRODUCTION

1.1 Background of Study

Due to poverty and the awful need to own vehicles for ease of movement, aging vehicles still attract customers from Ilorin's middle class and those at the lower tread of the economy. Large numbers are taken to automobile workshop for repair and refurbishing. Automobile workshops are important considering public health issues because they are carried out in poor environmental settings coupled with lack of safety and hygienic lifestyle (eating with unwashed hand, wearing of dirty and contaminated workshop clothes for a long time, etc.) of workshop artisans, yet it is a beehive of activities because it has become the source of employment to several informal sector workers such as auto repair, servicing and refurbishing, auto parts scavenging, car wash, tire pumping and repair, auto electrician, wheel balancing and alignment, oil sales and servicing, spare parts sales, water and food vendor, etc. (Ajayi & Dosunmu, 2002) An automobile is a machine whose ultimate designed function is to transport men and goods. It is also called a motor car (Rajput, 2007). It is a self-propelled vehicle which contains the power source for its propulsion and is used for transporting passengers and goods on the ground, such as car, bus, trucks, articulated vehicles, etc. It is also a transportation equipment unit which consists of a frame supporting the body and certain power developing and transmitting units which are further supported by tires and wheels through springs and axles. An automobile is simply anything vehicular that has its own power source and it is mobile. (Adie, Osibanjo, 2009).

Apart from esthetic pollution, automobiles and automobile workshop contributes significantly to environmental and public health discourse. Several literatures have documented that pollutant such as heavy metals, benzene, nitrobenzene, gasoline fumes, exhaust gases, particulate matter, etc. are released by activities at auto workshops and automobile have

negatively affected surface and underground water and adjacent farmlands. In a city such as Ilorin, (The World Gazetteer, 2013) automobile workshops are in clusters along major roads comprising unregulated activities such as auto mechanics and panel beaters (car body work). (Dioka et al, 2004). Large expanse of would have been arable lands are occupied and polluted (Enikanselu, 2008). Drainage system is blocked by waste generated from automobile workshops, heavy metals, waste oils, and noxious gases that are released into the environment, adjacent farmlands and food crops, which may possibly be contaminated by heavy metals and toxic substances. Exposed subjects at automobile workshops (auto technicians) are established to have high risk of cardiovascular and pulmonary diseases (Holman-Dodds, Bradley & Potter 2012)

Tremendous growth has occurred in the automobile industry, after the designing of internal combustion engines. (Abam & Unachukwu, 2009). Today, the automobile industry plays a crucial role in the social, economic, and industrial growth of any country. Automobiles offer very advantageous help to man such as movement of people and goods to their places of interest (such as city to city, city to the hinter land, church or religious activities, markets, schools, tourist sites, cross borders of countries, etc.). Sports cars are for sporting activities, sometimes for other personal interest, luxury, and entertainment. Increasing the number of automobiles on any country road means increased traffic-related problem such as road congestion, increase in ambient air temperature due to engine heating and exhausts combustion, delayed time of movement, and traffic emission pollution. (Nduka, Amuka & Sale, 2015)

Another emerging problem associated with automobile transportation is the ever-increasing automobile waste, for the fact that large volumes of aging vehicles are imported into Nigeria, coupled with lack of adequate legislation on life span of vehicles to be imported into Nigeria. It becomes an all-comers affair, and the effect is that aged, rickety, worn-out automobiles dot the Nigerian environment. Climatic factors such as acidic rain, moisture (dew) and sun act on

them as they corrode degrade and decompose to release toxic chemicals into the environment (Fakayode & Onianwa, 2002). This in addition to others constitutes environmental and public health issue (Berstein et al., 2008).

1.2 Statement of Problem

Waste from the production and use of vehicles can greatly impact public health. The transition to use of autonomous vehicles will improve public health issues contributing to the burden of disease, some of which are caused by automotive waste (Berstein et al., 2008). The key issues studied were car emissions and pollution, mobility of those unable to drive, driver stress, crashes, and cyclist safety. In urban settlements like Ilorin, the number of motor vehicles is high and as such there is congestion of traffic. When these vehicles congest in a singular area, the emission per kilometer goes up, contributing to vehicular pollution. One of the leading effects of vehicular pollution is global warming, poor air quality, reduced visibility as a result of carbon emissions, health issues and complications like lung infections and various kinds of cancers, acidic rain and even and negatively affects tourism. Traces of metal found in storm water runoff have also been linked to vehicular use. (Abam & Unachukwu, 2009)

The health benefits of autonomous vehicles are not well known, and public education may lead to greater support for their adoption (Nduka, Amuka & Sale 2015). A significant contribution of automotive waste to public health issues is air pollution. Some studies focused specifically on particulate matter emissions and their impact on human health (Nduka, Kelle & Amuka, 2019). Particulate matter concentrations and the disease burden caused by exposure to this pollution are expected to worsen in Ilorin if preventive measures are not improved, as the economy and industry develops. Particulate matter emitted outdoors affects indoor air quality, as buildings do not provide complete protection from outdoor air. This impacts human health as people spend quality of their time inside (Berstein et al 2008).

FeOx aerosols, another component of air pollution, are created by the combustion of diesel engines and the wear of car brakes. Due to a lack of observed data, their abundance in the atmosphere is unknown. Though pollution is high, the lack of health impact studies makes it difficult to determine how local populations are affected. As the arctic region develops and tourism increases, the ability to determine emission sources and their impact on human health is key (Nwachukwu, Feng & Achilike, 2010).

Black carbon emissions contribute to poor air quality and climate change in the arctic. The European Union regulates black carbon emissions as part of its Arctic policy. These regulations include emission requirements for diesel vehicles, significant contributors to black carbon pollution (Mazumder, 2008).

This project intends to find out the impacts of the automobile wastes on the general environment and the public health where these automobile vehicles are been operated.

1.3 Purpose of the Study

The purpose of this study is to assess environmental and public health impact of automobile wastes in Ilorin Kwara state. Specifically, the study will determine:

1. Sources of automobile waste in Kwara state.
2. Forms of Automobile waste in Kwara state.
3. environmental and public health impacts of automobile wastes in Kwara State.
4. Strategies for managing automobile wastes in Kwara State.

1.4 Research Questions

The following research questions were formulated to guide the study:

1. What are the sources of Automobile wastes in Kwara State?
2. What are the forms of Automobile wastes in Kwara State?

3. What are the environmental and public health impact of Automobile wastes in Kwara State?

4. What are the strategies for managing Automobile wastes in Kwara State?

1.5 Research Hypotheses

H_1: There is a statistically significant relationship between sources of Automobile waste in Kwara State and its impact on the environment and public health.

H_2: There is a statistically significant relationship between the strategies for managing Automobile waste in Kwara State and mitigation of the environmental and public health impacts of the waste.

1.6 Significance of the Study

The findings of this study would be beneficial to automobile industries, waste management agencies, policy makers, researchers, ministry of education, institutions and the society at large. The outcome of the study would be beneficial to the automobile manufacturers and policy makers in planning and decision making in automobile design matters.

This is study will educate the society on the dangers of improper disposal of automobile wastes and its detrimental effect on the environment and public health. This will also be of great relevance to researchers in the world of academics, ministry of education in the sense that the findings generated from this study will contribute immensely to existing body of knowledge and also assist subsequent studies. It is expected that this study will be one of the references for other researchers to get information about the environmental and public health impacts of automobile wastes.

The study would also help Ministry of health and policy makers identify the sources of these wastes and the areas where they are most likely to accumulate. This information can be used

to develop strategies for proper disposal of these wastes as well as to identify areas where additional measures may be needed to reduce the environmental and public health risks associated with these wastes.

Finally, the study of the environmental and public health impacts of automobile wastes in Ilorin, Kwara State, can help inform policymakers and other stakeholders about the potential risks associated with these wastes. This information can be used to develop policies and regulations that can help reduce the environmental and public health risks associated with these wastes. This can help to ensure that the environment and public health are protected from the potential risks associated with automobile waste.

1.7 Scope of the study

This study focuses on assessing the environmental and public health impact of automobile wastes in Ilorin, Kwara state. It is also the intent of the researcher to investigate the various forms of automobile wastes and their sources and determine automobile waste management practices.

1.8 Area of Study

Ilorin is the state capital of Kwara state in western Nigeria. As of 2006 census, it had the population of 777, 667, making it the 7th largest city by population in Nigeria. (FRN 2006)

Map of Ilorin

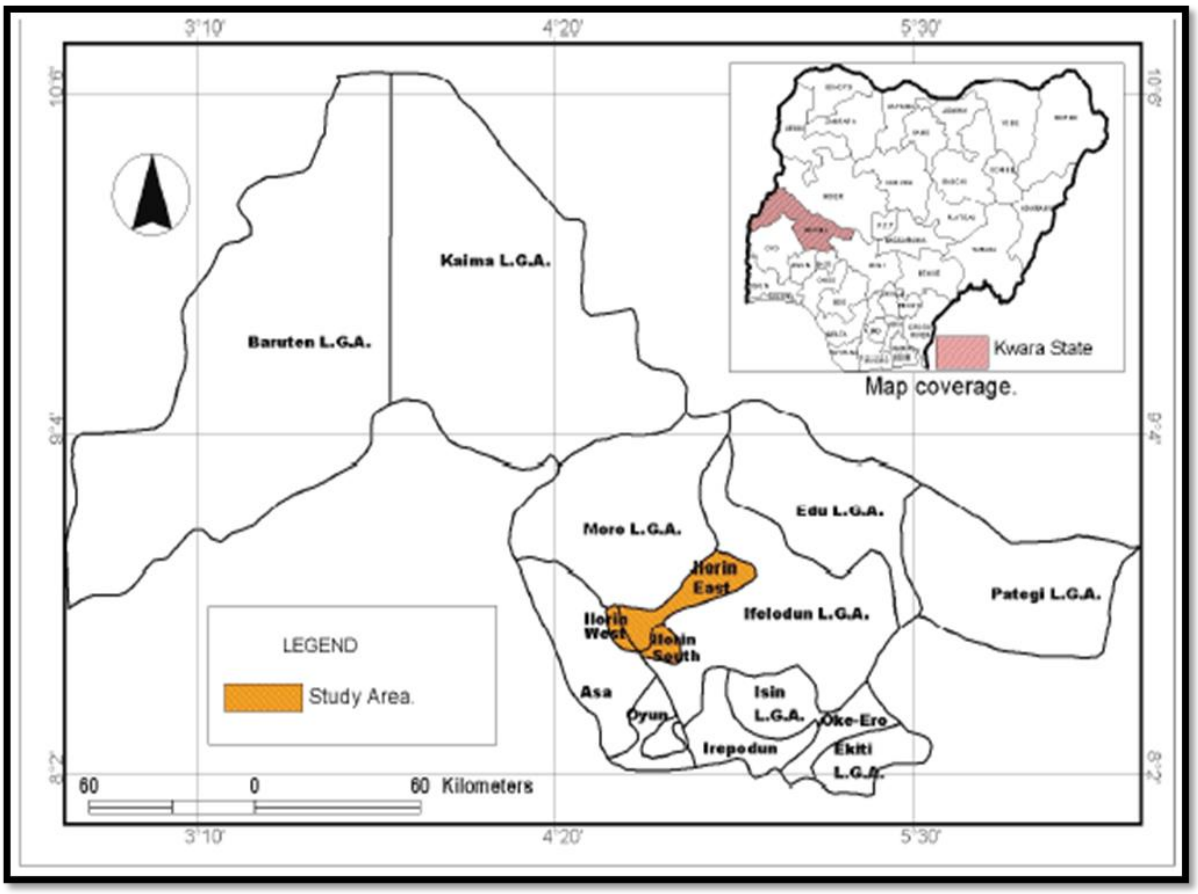

Fig 1.1 Map of Kwara state Nigeria showing the study area Ilorin.
Source: Joseph et al. (2016)

CHAPTER TWO

REVIEW OF RELATED LITERATURE

The review of literature for this study was organized under the following sub-headings

Conceptual framework

- Automobile
- Sources of automobile pollutants
- Impact of Automobile Pollutants on the Environment and General Public

Theoretical Framework

- Automobile Waste and Pollution Control
- Use of Remote Sensing Technology
- Modification on cost effective and high efficiency
- Curtailed use of private Vehicles
- Car pooling
- Staged Working Scheme of automobile users
- Dedication to the improvement of environmental health standard

Review of Empirical Studies

Research Gap

2.1 Conceptual Framework

2.1.1 Automobile

Automobile is a vehicle driven by an internal combustion engine and it is used for transportation of passengers and goods on the ground. Automobile can also be defined as a vehicle which can move by itself. These include cars, trucks, motorcycles and boats (anything that burns gas). They leave oil, antifreeze, grease and metals on streets and driveways. They

also emit nitrogen and other contaminants, which settle in water. (Auffhammer & Carson, 2008)

Automotive bodies are generally formed out of sheet steel. The steel is alloyed with various elements to improve its ability to be formed into deeper depressions without wrinkling or tearing in manufacturing presses. Steel is used because of its general availability, low cost, and good workability (Bindra et al, 2018). For certain applications, however, other materials, such as aluminum, fiber, and carbon-fibre reinforced plastic, are used because of their special properties. Polyamide, polyester, polystyrene, polypropylene, and ethylene plastics have been formulated for greater toughness, dent resistance, and resistance to brittle deformation. These materials are used for body panels. Tooling for plastic components generally costs less and requires less time to develop than that for steel components and therefore may be changed by designers at a lower cost (Bindra et al, 2018).

To protect bodies from corrosive elements and to maintain their strength and appearance, special priming and painting processes are used. Bodies are first dipped in cleaning baths to remove oil and other foreign matter (BTRE, 2002). They then go through a succession of dip and spray cycles. Enamel and acrylic lacquer are both in common use. Electrode position of the sprayed paint, a process in which the paint spray is given an electrostatic charge and then attracted to the surface by a high voltage, helps assure that an even coat is applied and that hard-to-reach areas are covered. Ovens with conveyor lines are used to speed the drying process in the factory. Galvanized steel with a protective zinc coating and corrosion-resistant stainless steel are used in body areas that are more likely to corrode. (Purdy, 2018).

2.2 Sources of Automobile Pollutants

Motor vehicles are the single biggest source of atmospheric pollution, contributing an estimated 14% of the world's carbon dioxide emissions from fossil fuel burning, a proportion than is

steadily rising. (WHO, 2018) Add the emissions from exploration, transportation, refining and distribution of fuel, and this figure if 15 to 20 percent of world emissions. Generally, sources of automobile pollutants include the following:

Firstly, is the Hydrocarbons which is a class of burned or partially burned fuel; hydrocarbons are toxins and is a major contributor to smog, which can be a major problem in urban areas. (Dongzi et at, 2012)

The second is Carbon monoxide (CO). A product of incomplete combustion, carbon monoxide reduces the blood's ability to carry oxygen. Nitrogen oxides (NO_x) which is the third is generated when nitrogen in the air reacts with oxygen at the high temperature and pressure inside the engine it is one of the most directly toxic substances, it affects human health by impairing the oxygen carrying capacity of the blood causing impaired perception, slowing reflexes and drowsiness. It can increase occurrence of headaches and affects the central nervous system, the heart and the transference of blood around the body. In large doses, it is fatal. Particulate matter which is Soot or smoke made up of particles in the micrometer size range is also a major source of automobile pollution. (Harish, 2012)

Sulfur oxide (SO_x) is also a general term for oxides of Sulphur, which are emitted from motor vehicles burning fuel containing a high concentration of Sulphur. It causes soil and water acidification, damage to plants.

2.3 Impact of Automobile Pollutants on the Environment and General Public

Automobiles are a necessary evil, while they have made living easy and convenient; they have also made human life more complicated and vulnerable to both toxic emissions and an increased risk of accidents (Guarnieri & Balmes 2014). Urban people are most affected and amongst the worst sufferers are traffic police men, neighbouring settlements that are particularly close to the fumes of automobile exhaust. (Harish, 2012)

Prolonged exposure to hydrocarbons contributes to asthma, liver disease, and cancer, overexposure of carbon monoxide poisoning may be fatal as revealed by Jiang, Mei and Feng (2016). NOx which is also part of the pollutants is a precursor to smog and acid rain. It is a mixture of NO and NO_2. NO_2 destroys resistance to respiratory infection. Particulate matter causes negative health effects, including but not limited to respiratory diseases (Kelishadi & Poursafa, 2010).

Oil, petroleum products and other toxins from automobiles kill fish, plants, aquatic life and even people. One quart of oil will contaminate thousands of gallons of water because it doesn't dissolve (Eze et al, 2014). These toxins as well as trace metals and degreasing agents used on automobiles contaminate drinking water and can cause major illness. Some of these toxins and metals are absorbed in various sea life and cause medical problems to people when eaten. (Yasin et al. 2012 and Genc et al, 2012).

2.4 Theoretical Framework

In the 1960's, a strong public conscience about the environment was developed. Subsequent years reveal a great deal about our ability to better understand and manage the environment in socially acceptable ways. This task will require both theories and measurement techniques to empirically verify them. A welfare theory (based largely on Paretian welfare economics) states that we can say one system is preferable to another if the system makes at least one person better off and no one worse off. Most alternative systems in the real world, including those available to resolve pollution conflicts, do not meet this criterion. A change in the system normally makes someone worse off. Thus, Paretian, or the "new," welfare economics, is not really useful in making most policy decisions. The problem is compounded, because often we do not know how to measure the real effects of pollution on parties involved in and influenced

by pollution. This later problem is aggravated by the fact that we have done very little to systematically record observations on pollution processes (Langham, 2015).

2.4.1 Automobile Waste and Pollution Control

At the global level, the rapid growth in motor vehicle activity has serious energy security and climate change implications. The transport sector already consumes nearly half of the world's oil. But in urban areas – both developing and developed countries, it is predominately mobile or vehicular pollution that contributes to air quality problem. (Harish 2012)

One of the main problems that are overlooked across the globe is pollution. (Manucci & Franchini, 2017). The Pollution is evident in many different forms, such as, water, sound, light, radioactive, land, and air. The only way is to reduce the problem of air pollution is the elimination or reduction of fossil fuels used by vehicles (Ashfaq & Sharma 2012).

2.4.1.1 Use of Remote Sensing Technology

Remote sensing technology measures the pollutant level during the vehicle's exhaust while vehicle is travelling down the road. Unlike the conventional methods, the remote sensing devices are not physically connected to the vehicle. The paper highlights how to achieve almost zero percent pollution and prevent the environment from vehicle emission (Ashfaq & Sharma, 2012).

2.4.1.2 Modification on cost effectiveness and high efficiency

Due to today's strict emissions and fuel economy standards to which manufacturers have to conform, most new cars bought these days are actually capable of performing far better than they are advertised. One of the first-developed exhaust emission control systems is secondary air injection. Originally, this system was used to inject air into the engine's exhaust ports to provide oxygen so unburned and partially-burned hydrocarbons in the exhaust would finish burning (Spiegel & Maystre, 2019). Air injection is now used to support the catalytic converters oxidation reaction, and to reduce emissions when an engine is started from cold.

After a cold start, an engine needs a fuel-air mixture richer than what it needs at operating temperature, and the catalytic converter does not function efficiently until it has reached its own operating temperature.

The air injected upstream of the converter supports combustion in the exhaust head pipe, which speeds catalyst warm up and reduces the amount of unburned hydrocarbon emitted from the tailpipe. Converter does not function efficiently until it has reached its own operating temperature. The air injected upstream of the converter supports combustion in the exhaust head pipe, which speeds catalyst warm up and reduces the amount of unburned hydrocarbon emitted from the tailpipe. The catalytic converter is a device placed in the exhaust pipe, which converts hydrocarbons, carbon monoxide, and NO_x into less harmful gases by using a combination of platinum, palladium and rhodium as catalysts (Moores, 2009).

Evaporative emissions control-Emissions are the result of gasoline vapours escaping from the vehicle's fuel system. In a typical system, vapours from the fuel tank and carburettor bowl vent (on carburetted vehicles) are ducted to canisters containing activated carbon. The vapours are adsorbed within the canister, and during certain engine operational modes fresh air is drawn through the canister, pulling the vapour into the engine, where it is burned. (NEPIS, 2017)

2.4.1.3 Curtailed use of private Vehicles

Reducing vehicles used across the city can cut carbon dioxide emissions by thousands of tones (USEPA, 2011) As mention before, efficiency is unquestionably the largest, cheapest, and cleanest wedge among the many we need to rid carbon from our energy economy.

Avoiding unnecessary driving is the most effective way to reduce vehicle emissions; however, traffic trends indicate more vehicles are being driven more frequently due to urban sprawl. The options we have available to reduce the number of vehicles being driven on our roads (Bull, 2003).

2.4.1.4 Car Pooling

The employers, or groups of employers, find it convenient to have one or more cars or vans that are readily available for business use by a number of employees. The cars or vans are not allocated to any one employee and are only available for genuine business use. Such cars and vans are usually known as pooled cars and vans (Yasin et al 2012)

2.4.1.5 Staged Working Scheme of automobile users

This explains having different times for the people employed state Government, Central Government, Corporate, Banks and Financial institutions, educational institutions, and public sector etc. This should be introduced in the developed and developing countries based on the congestion and the level of pollution. This will help the citizens or employer will be healthy and can drive his vehicle during their office timings within the city based on their convenience as per the city. (WHO, 2016)

2.4.1.6 Dedication to the improvement of environmental health standard

The settlers should have commitment for the society as it helps in solving the problems related to pollution and the human health in Mysore. The people have to think in a manner that, the pollution is a problem of our house rather than the society which effects mankind and poisoning the environment by unwanted emissions from vehicles and make them unhealthy (Sharma & Pundir, 2008). It also includes Monitoring and repair of any leaks discovered in the vehicles used, taking used oil, batteries and other fluids to a repair shop for proper disposal, allowing oil or other toxins to runoff into the ground, street gutters or storm drains, Taking their cars to a commercial car wash or use detergents that don't contain phosphorus to wash your car and direct the flow of runoff to grass clippings or gravel instead of the street and when purchasing a new automobile, cars with high fuel efficiency ratings should be a priority (Pujal, 2021).

2.5 Review of Related Empirical Studies

Human activities have an adverse effect on the environment by polluting the water we drink, the air we breathe, and the soil in which plants grow. Although the industrial revolution was a great success in terms of technology, society, and the provision of multiple services, it also introduced the production of huge quantities of pollutants emitted into the air that are harmful to human health. Without any doubt, the global environmental pollution is considered an international public health issue with multiple facets. Social, economic, and legislative concerns and lifestyle habits are related to this major problem. Clearly, urbanization and industrialization are reaching unprecedented and upsetting proportions worldwide in our era. Anthropogenic air pollution is one of the biggest public health hazards worldwide, given that it accounts for about 9 million deaths per year. (WHO, 2019)

Moores, (2009) revealed that the entire aforementioned are closely associated with climate change, and in the event of danger, the consequences can be severe for mankind

Climate changes and the effects of global planetary warming seriously affect multiple ecosystems, causing problems such as food safety issues, ice and iceberg melting, animal extinction, and damage to plants (USGCRP, 2009)

Air pollution has various health effects. The health of susceptible and sensitive individuals can be impacted even on low air pollution days. Short-term exposure to air pollutants is closely related to COPD (Chronic Obstructive Pulmonary Disease), cough, shortness of breath, wheezing, asthma, respiratory disease, and high rates of hospitalization (a measurement of morbidity). (Marlon et al., 2019)

The long-term effects associated with air pollution are chronic asthma, pulmonary insufficiency, cardiovascular diseases, and cardiovascular mortality. According to a Swedish cohort study, diabetes seems to be induced after long-term air pollution exposure (Eze et al, 2014)

Moreover, air pollution seems to have various malign health effects in early human life, such as respiratory, cardiovascular, mental, and prenatal disorders, leading to infant mortality or chronic disease in adult age (Kelishadi & Poursafa, 2010).

National reports have mentioned the increased risk of morbidity and mortality (WHO, 2019). These studies were conducted in many places around the world and show a correlation between daily ranges of particulate matter (PM) concentration and daily mortality. Climate shifts and global planetary warming could aggravate the situation. Besides, increased hospitalization (an index of morbidity) has been registered among the elderly and susceptible individuals for specific reasons. Fine and ultrafine particulate matter seems to be associated with more serious illnesses (Kelishadi & Poursafa, 2010), as it can invade the deepest parts of the airways and more easily reach the bloodstream. Air pollution mainly affects those living in large urban areas, where road emissions contribute the most to the degradation of air quality. There is also a danger of industrial accidents, where the spread of a toxic fog can be fatal to the populations of the surrounding areas. The dispersion of pollutants is determined by many parameters, most notably atmospheric stability and wind.

Manucci and Franchini (2017) revealed that in developing countries, the problem is more serious due to overpopulation and uncontrolled urbanization along with the development of industrialization. This leads to poor air quality, especially in countries with social disparities and a lack of information on sustainable management of the environment. The use of fuels such as wood fuel or solid fuel for domestic needs due to low incomes expose people to bad-quality, polluted air at home. It is of note that three billion people around the world are using the above sources of energy for their daily heating and cooking needs (8). In developing countries, the women of the household seem to carry the highest risk for disease development due to their longer duration exposure to the indoor air pollution (Hashim & Boffetta 2014). Due to its fast-

industrial development and overpopulation, China is one of the Asian countries confronting serious air pollution problems (Guo et al, 2017).

Dockery el al, 1993 discussed that an association of pollution with mortality was reported on the basis of monitoring of outdoor pollution in six US metropolitan cities. In every case, it seems that mortality was closely related to the levels of fine, inhalable, and sulphate particles more than with the levels of total particulate pollution, aerosol acidity, sulphur dioxide, or nitrogen dioxide.

Furthermore, extremely high levels of pollution are reported in Mexico City and Rio de Janeiro, followed by Milan, Ankara, Melbourne, Tokyo, and Moscow (Kassomenos et al., 2011).

Based on the magnitude of the public health impact, it is certain that different kinds of interventions should be considered. Success and effectiveness in controlling air pollution, specifically at the local level, have been reported. Adequate technological means are applied considering the source and the nature of the emission as well as its impact on health and the environment. The importance of point sources and non-point sources of air pollution control is reported by Schwela and Köth-Jahr (1994)

Benson and Jordan, (2017) discussed that a detailed emission inventory must record all sources in a given area. Beyond considering the above sources and their nature, topography and meteorology should also be considered, as stated previously. Assessment of the control policies and methods is often extrapolated from the local to the regional and then to the global scale. Air pollution may be dispersed and transported from one region to another area located far away. Air pollution management means the reduction to acceptable levels or possible elimination of air pollutants whose presence in the air affects our health or the environmental ecosystem. Private and governmental entities and authorities implement actions to ensure the air quality. Air quality standards and guidelines were adopted for the different pollutants by the WHO and EPA as a tool for the management of air quality (NEPIS 2017). These standards

have to be compared to the emissions inventory standards by causal analysis and dispersion modelling in order to reveal the problematic areas. Inventories are generally based on a combination of direct measurements and emissions modelling (NRC, 2019).

As an example, we state here the control measures at the source through the use of catalytic converters in cars. These are devices that turn the pollutants and toxic gases produced from combustion engines into less-toxic pollutants by catalysis through redox reactions (Bull, 2003). In Greece, the use of private cars was restricted by tracking their license plates in order to reduce traffic congestion during rush hour (Bull, 2003).

Technological innovation can only be successful if it is able to meet the needs of society. In this sense, technology must reflect the decision-making practices and procedures of those involved in risk assessment and evaluation and act as a facilitator in providing information and assessments to enable decision makers to make the best decisions possible. Newlands (2015) Summarizing the aforementioned in order to design an effective air quality control strategy, several aspects must be considered: environmental factors and ambient air quality conditions, engineering factors and air pollutant characteristics, and finally, economic operating costs for technological improvement and administrative and legal costs. Considering the economic factor, competitiveness through neoliberal concepts is offering a solution to environmental problems.

Newlands (2015) revealed that the development of environmental governance, along with technological progress, has initiated the deployment of a dialogue. Environmental politics has created objections and points of opposition between different political parties, scientists, media, and governmental and non-governmental organizations. Radical environmental activism actions and movements have been created. Gibson and Ward argued that the rise of the new information and communication technologies (ICTs) are many times examined as to whether

and in which way they have influenced means of communication and social movements such as activism

Since the 1990s, the term “digital activism” has been used increasingly and in many different disciplines (Kaun &, Uldam, 2017). Nowadays, multiple digital technologies can be used to produce a digital activism outcome on environmental issues. More specifically, devices with online capabilities such as computers or mobile phones are being used as a way to pursue change in political and social affairs (Sivitanides & Shah 2011)

2.6 Research Gap

There are numerous researches on the impact of automobile waste and pollution on the environmental and public in different parts of the world especially the developing countries as demonstrated by the literature review above but there is a little research made on the area of interest of this research. However, this present paper is undertaken to assess the impact of automobile waste and pollution on environmental and public health in Ilorin and propose some solutions and interventions that may be of interest to environmental legislators and decision makers. This is vital information.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research Method

For the fulfillment of the study's aims the study selected the quantitative data type. Quantitative data is defined as the data value in counts or numbers where each data set has an associated unique numerical value. Quantitative data are measurable, mathematical computations and statistical analysis that allow for real-life choices based on mathematical results.

3.2 Research Design

This study adopted a survey research design. It is widely used in quantitative and qualitative research because it allows for efficient data gathering and analysis, as well as using data to generate study conclusions. Primary data will be collected using questionnaires. The results of the fieldwork will be analyzed using both descriptive and inferential statistical methods.

3.3 Population of the study

In this study, the population of the study includes the people who lives in Ilorin as at the period of this research. The population size of the study is 100 potential respondents

3.4 Sample and Sampling Technique

A sample is a smaller number of the population that is used to make final decisions based on the whole population. Sampling is the systematic method of choosing a number of individuals for a study to represent the larger group from which they were selected. For this study, purposive sampling technique was adopted. It is also known as judgmental sampling. It is a non-probability sample that is selected based on the judgment of the researcher when choosing

who to ask to participate as it relates to the characteristics of a population and the objective of the study. Purposive sampling technique consists of various types which can be used depending on the research objective. Specifically, the heterogeneous sampling technique also known as maximum variation is a purposive sampling that captures a wide range of perspectives relating to the interest of study ranging from those conditions that are considered typical to those conditions that are considered extreme. This sampling technique was selected because it is time and cost effective and will give room for the researcher to gain more insights on the study by looking at it from different angles.

3.5 Instrument for Data Collection.

An online questionnaire google form was adopted for the collection of data for the study, see Appendix 1.

The questionnaire would be grouped into five parts namely:

Section I: Personal data

Section II – IV: Impacts of automobile pollutants, Sources of automobile pollutants, Strategies for managing automobile waste.

The personal features of respondents are discussed to evaluate the context of the respondents and the effects of their replies.

3.6 Validation of research instrument

The instrument for this study was subjected to face validation. Face validation tests the appropriateness of the questionnaire items. This is because the face validation is often used to indicate whether an instrument on the face of it appears to measure what it contains. Face validation therefore aims at determining the extent to which the questionnaire items will be relevant to the objectives of the study and the research question.

3.7 Method of Data Analysis

To analyze the data, descriptive analysis through the use Weighted Mean Score (WMS), relative importance index and factor analysis would be used.

Relative Importance Index RII $= \frac{\Sigma W}{\mathrm{A}*\mathrm{N}}$

Where W is the weighting given to each factor by the respondents (ranging from 1 to 5), A is the highest weight (i.e 5 in this case) and N is the total number of respondents. The higher the value of RII the more the importance.

Likert Scaling: The Likert scaling to be used for the analysis will be scored on the five-point scale of: Strongly Agree (SA) 5 points, agree (A) 4 points, Undecided (I) 3 points, disagree (D) 2 points and Strongly Disagree (SD) 1 point. Values from each option will be multiplied with the corresponding points. The resulting figure for the options of a particular item will then be summed to arrive at the mean value which will now serve as the decisions by the researcher. The benchmark for decision making is shown below.

Table 3.1 Likert Scaling benchmark for decision making

SN	Benchmark	Decision
1	1.00 – 1.50	Strongly Disagree/ Very Poor
2	1.51 – 2.49	Disagree/ Poor
3	2.50 – 3.49	Undecided / Fair
4	3.50 – 4.49	Agree / Good
5	4.50 – 5.00	Strongly Agree/ Very Good

Source: Gail and Anthony, (2013)
Modified Rated Scale for Analysis and Interpretation, (2022)

3.7.1 Multiple Regression Model

A Regression model will be adopted to test the relationships between the study variables. The model for the analysis is shown below:

$Y = K + X_1 + X_2 + \ldots. X_n + e$

Where:

Y = dependent variable

K = Constant

X = Co-efficient

e = residual error

The regression model will be used to test for hypothesis in the study.

CHAPTER FOUR
PRESENTATION AND ANALYSIS OF DATA

4.1 Introduction

This chapter covers the presentation and analysis of data acquired for the purpose of this study. The data collected through primary sources are analyzed using descriptive and inferential statistical tools such as frequency tables, charts, multiple regression and ANOVA in line with the objective of the study.

4.2 Data presentation

The data presented in this chapter includes information acquired primarily through the use of questionnaires administered people who reside in Ilorin. A total of 74 questionnaires were administered puposely to the selected people, 100% (74) of the questionnaires were returned valid and appropriately filled and the questionnaires were analyzed in this chapter.

4.3 Socio-economic Characteristics of Respondents

The socio-economic characteristics of respondent analyzed in this section include age, the educational level of the respondents and automobile usage experience of the respondents.

4.3.1 Age group of the respondents

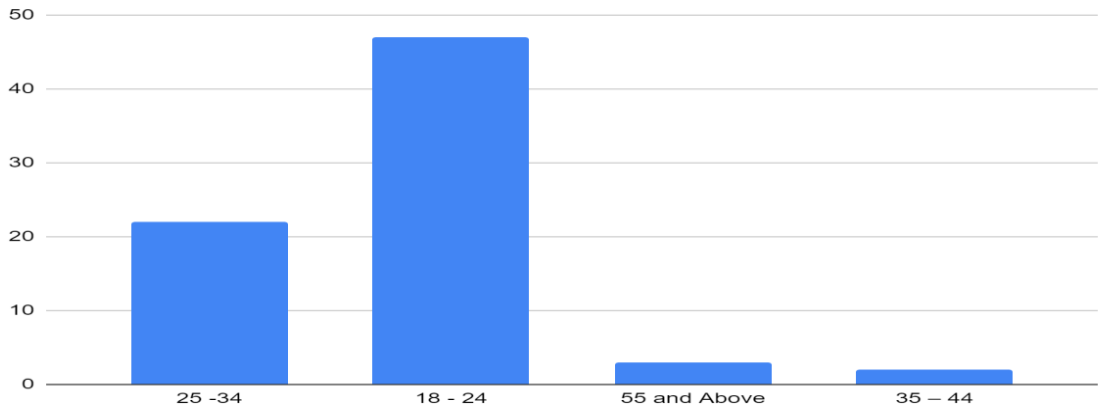

Figure 4.1 Age group of the respondents

Source: Author's computation, (2023)

Figure 4.1 shows that the age group of the respondents, the predominant age group is between 18 – 24 years with 63.5% represents 47 respondents, 22 respondents representing 29.7% for the next dominant age group is between 25 – 34 years age group, while 55 and above years age group accounts for 4.1% representing 3 respondents, 35 - 44 years of age represents 2.7% represents 2 respondents. From this analysis, it can be deduced that the active population is within the youth age group. This implies that that the active population that has a significant impact on the environment and public health is within the youth age group. This age group is generally more active and mobile, which means they are more likely to use automobiles and, as a result, generate more waste that can impact the environment and public health. Also, the fact that the majority of the respondents are within the youth age group could suggest that there is a need to educate this population on the importance of proper waste management and the impact of automobile waste on the environment and public health.

4.3.2 Educational level of the respondents

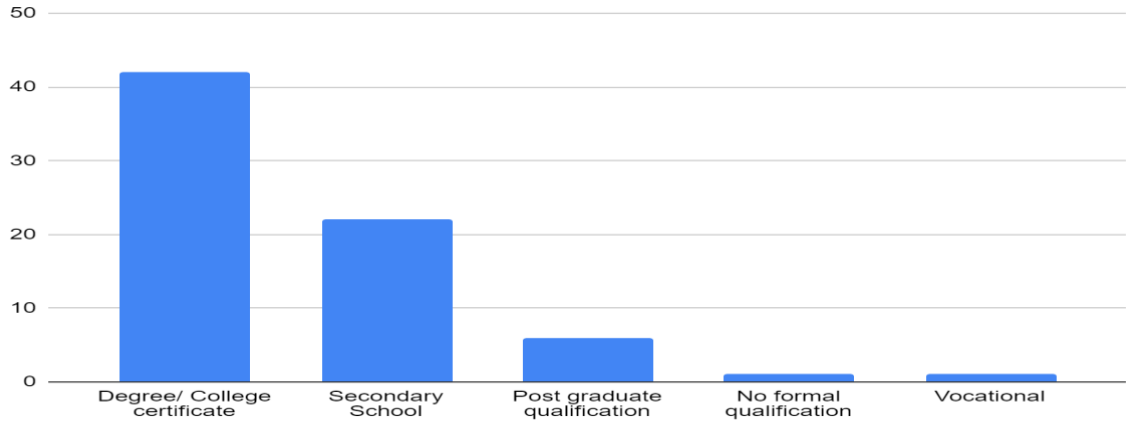

Figure 4.2 Educational level of the respondents
Source: Author's computation, (2023)

From the analysis in Figure 4.2 the population with vocational certificates represents 1.4% of the respondents, 1.4% of the respondents had no formal qualification, those with secondary level of education represent 30.6% of the respondents, while 58.3% of the respondents had degree/college certificates and 8.3% of the respondents had post graduate qualification. It is observed that most of the respondents have attained tertiary levels in education. The result

implies that the high proportion of respondents with tertiary levels of education suggests that there is potential for education and awareness campaigns to be effective in reducing the environmental and public health impact of automobile waste in Ilorin, Kwara State. It also indicates that there may be opportunities to engage and leverage the knowledge and expertise of educated individuals in developing more sustainable and environmentally-friendly solutions.

4.3.3 Automobile Usage Experience of the respondents

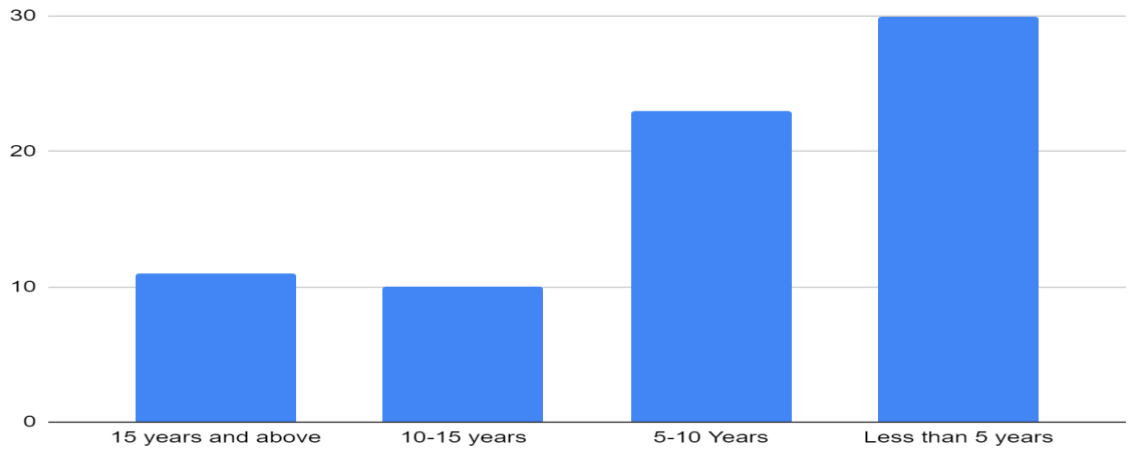

Figure 4.3 Automobile Usage Experience of the respondents
Source: Author's computation, (2023)

Figure 4.1 shows that the automobile usage experience of the respondents, 30 respondents representing 40.5% has less than 5-year experience, 23 respondents representing 31.1% has 5 - 10-year experience, 10 respondents representing 13.5% has 10 - 15-year experience and 11 respondents representing 14.9% has 15 and above year experience. This implies that the level of experience in automobile usage may affect the amount and type of waste generated by automobile users and the potential impact of such waste on the environment and public health. Inexperienced drivers may be more likely to engage in unsafe driving practices, leading to increased emissions and pollutants. They may also be less knowledgeable about the proper disposal of automotive waste, which could lead to improper disposal and pollution of the environment. In contrast, experienced drivers may be more aware of the environmental impact of their actions and may take measures to reduce their waste generation.

4.4 Types of automobile wastes in Ilorin

Table 4.1 Response on the types of automobile wastes in Ilorin

S/N	Automobile waste types	Strongly agreed	Agreed	Response undecided	Scale Disagreed	Strongly disagreed	Total Response
		5	4	3	2	1	
1	Car Parts such as tires, oil filters, glass, plastic, and metal	16	34	7	8	9	74
2	Automotive Fluids such as Motor oil, brake fluid, transmission fluid, and other automotive fluids	9	35	9	14	7	74
3	Automotive batteries and coolants	6	28	10	23	7	74
4	Fluorescent Bulbs	11	20	13	23	7	74

Source: Author's computation, (2023)

Table 4.1 Shows the summary of the response on the types of automobile wastes in Ilorin

Table 4.2 Interpretation of the responses on the types of automobile waste in Ilorin

S/N	Automobile waste types	Weighted Response	Weighted mean score	Interpretation
1	Car Parts such as tires, oil filters, glass, plastic, and metal	262	3.54	Agreed
2	Automotive Fluids such as Motor oil, brake fluid, transmission fluid, and other automotive fluids	247	3.34	Undecided
3	Automotive batteries and coolants	225	3.04	Undecided
4	Fluorescent Bulbs	227	3.07	Undecided

Source: Author's computation, (2023)

Table 4.2 provides the interpretation of the responses on the types of automobile waste in Ilorin. The weighted response for each waste type was calculated based on the responses from Table 4.1. The weighted mean score was also calculated by dividing the total weighted response by the total number of responses (74). From the table, it can be observed that the respondents agreed (weighted mean score of 3.54) that car parts such as tires, oil filters, glass, plastic, and metal constitute automobile waste in Ilorin. However, the respondents were undecided on the other types of automobile waste: automotive fluids such as motor oil, brake fluid, transmission fluid, and other automotive fluids; automotive batteries and coolants; and fluorescent bulbs. Their weighted mean scores were all around 3.0, which is considered as an undecided response. The implication of this result is that there is a need for further education and awareness among

the population on the types of automobile waste and their potential impact on the environment and public health. This is particularly important for the undecided waste types, as the respondents may not be aware of the potential hazards associated with their improper disposal. It is essential to sensitize the public and provide them with appropriate knowledge on how to handle and dispose of these waste types properly.

4.5 Sources of automobile wastes in Ilorin

Table 4.3 Responses on sources of automobile wastes in Ilorin

S/N	Sources of automobile waste	Response Scale Strongly agreed	Agreed	undecided	Disagreed	Strongly disagreed	Total Response
		5	4	3	2	1	
1	Manufacturing plants and Automotive repair shops	8	33	12	15	6	74
2	Used oil, fuel and other hazardous materials from vehicles are often disposed of improperly and Scrap yard operations	18	30	9	10	7	74

Source: Author's computation, (2023)

Table 4.3 Shows the summary of the response on sources of automobile wastes in Ilorin

Table 4.4 Interpretation of the responses on the sources of automobile wastes in Ilorin

S/N	Automobile waste types	Weighted Response	Weighted mean score	Interpretation
1	Manufacturing plants and Automotive repair shops	244	3.30	Undecided
4	Used oil, fuel and other hazardous materials from vehicles are often disposed of improperly and Scrap yard operations	264	3.57	Agreed

Source: Author's computation, (2023)

Table 4.4 shows the interpretation of the responses on the sources of automobile wastes in Ilorin. The weighted mean score for "Manufacturing plants and Automotive repair shops" is 3.30, indicating an undecided interpretation. This means that respondents were not completely sure if manufacturing plants and automotive repair shops were sources of automobile wastes in Ilorin. On the other hand, the weighted mean score for "Used oil, fuel and other hazardous materials from vehicles are often disposed of improperly and Scrap yard operations" is 3.57,

indicating an agreed interpretation. This means that respondents were more certain that used oil, fuel, and other hazardous materials from vehicles are often disposed of improperly, and scrap yard operations contribute to the sources of automobile wastes in Ilorin.

4.6 Environmental and Health risks associated with automobile wastes in Ilorin

Table 4.5 Responses on Environmental and Health risks associated with automobile wastes

S/N	Automobile Risks	Strongly agreed	Agreed	Response undecided	Scale Disagreed	Strongly disagreed	Total Response
		5	4	3	2	1	
1	Respiratory diseases as a result of Toxic Fumes from cars which may contain toxins such as carbon monoxide and Air pollution which can lead to respiratory illnesses such as asthma and bronchitis	20	30	8	7	9	74
2	Ground Water Contamination as a result of automobile fluids, such as oil and antifreeze released to the ground and soil Contamination as a result of heavy metals leaching into the soil and affecting local flora and fauna	18	32	12	7	6	74
3	Cancer as a result of release from automobile exhaust which may contain a variety of carcinogens and lead Poisoning as a result of Lead released from car batteries	18	29	13	9	5	74
4	Faulty car parts or spilled fuels which can lead to the risk of fire or explosions	18	37	6	7	6	74

Source: Author's computation, (2023)

Table 4.5 Shows the summary of the response on environmental and health risks associated with automobile wastes

Table 4.6 Ranking and Interpretation on Environmental and Health risks associated with automobile wastes

S/N	Automobile Risks	Weighted Response	Weighted mean score	Interpretation	RII	Rank
1	Respiratory diseases as a result of Toxic Fumes from cars which may contain toxins such as carbon monoxide and Air pollution which can lead to respiratory illnesses such as asthma and bronchitis	267	3.61	Agreed	0.722	4th
2	Ground Water Contamination as a result of automobile fluids, such as oil and antifreeze released to the ground and soil Contamination as a result of heavy metals leaching into the soil and affecting local flora and fauna	270	3.65	Agreed	0.730	2nd
3	Cancer as a result of release from automobile exhaust which may contain a variety of carcinogens and lead Poisoning as a result of Lead released from car batteries	268	3.62	Agreed	0.724	3rd
4	Faulty car parts or spilled fuels which can lead to the risk of fire or explosions	276	3.73	Agreed	0.746	1st

Source: Author's computation, (2023)

Based on the weighted response and weighted mean score in Table 4.6, it can be interpreted that the respondents agreed that there are environmental and health risks associated with automobile wastes in Ilorin. The risks were ranked in order of importance using the Relative Importance Index (RII) and the rank is shown in the last column. The highest ranked risk is the risk of fire or explosion due to faulty car parts or spilled fuels, with a weighted mean score of 3.73 and an RII of 0.746. The risk of ground water contamination and soil contamination as a result of automobile fluids and heavy metals leaching into the soil was ranked second with a weighted mean score of 3.65 and an RII of 0.730. The risk of respiratory diseases and air pollution as a result of toxic fumes from cars was ranked fourth with a weighted mean score of

3.61 and an RII of 0.722, while the risk of cancer and lead poisoning was ranked third with a weighted mean score of 3.62 and an RII of 0.724. The respondents hence, appear to be aware of the environmental and health risks associated with automobile wastes and agree that measures should be taken to address these risks.

4.7 Potential Solutions and Technologies for Managing Automobile Waste (Disposal Practices)

Table 4.7 Potential Solutions and Technologies for Managing Automobile Waste (Disposal Practices)

S/N	Potential Solutions	Response Scale					
		Strongly agreed	Agreed	Undecided	Disagreed	Strongly disagreed	Total Response
		5	4	3	2	1	
1	Recycling automotive parts and materials is a great way to reduce waste and preserve resources	38	22	4	1	9	74
2	Reusing car parts and materials	22	32	7	9	4	74
3	Automotive waste donation to charities or local workshops	17	31	13	10	3	74
4	Design and introduction of Eco-friendly automobiles to reduce carbon emissions and improve fuel efficiency	25	30	11	2	6	74
5	Use of Automated collection systems designed to collect and process automobile waste	25	31	8	6	4	74
6	Industrial Composting - a process in which automotive waste is broken down and converted into compost	28	25	8	6	7	74

Source: Author's computation, (2023)

Table 4.7 Shows the summary of the response on potential solutions and technologies for managing automobile waste (Disposal Practices)

Table 4.8 Ranking and Interpretation on the Potential Solutions and Technologies for Managing Automobile Waste (Disposal Practices)

S/N	Automobile Risks	Weighted Response	Weighted mean score	Interpretation	RII	Rank
1	Recycling automotive parts and materials is a great way to reduce waste and preserve resources	301	4.07	Agreed	0.814	1st
2	Reusing car parts and materials	281	3.80	Agreed	0.760	5th
3	Automotive waste donation to charities or local workshops	271	3.66	Agreed	0.732	6th
4	Design and introduction of Eco-friendly automobiles to reduce carbon emissions and improve fuel efficiency	288	3.89	Agreed	0.778	3rd
5	Use of Automated collection systems designed to collect and process automobile waste	289	3.91	Agreed	0.782	2nd
6	Industrial Composting - a process in which automotive waste is broken down and converted into compost	283	3.82	Agreed	0.764	4th

Table 4.8 shows the ranking and interpretation of the potential solutions and technologies for managing automobile waste based on the weighted response and weighted mean score. The ranking was determined using the Relative Importance Index (RII), which measures the level of agreement with each solution on a scale of 1 to 5. The results indicate that recycling automotive parts and materials is the most agreed-upon solution, with a weighted mean score of 4.07 and an RII of 0.814, followed closely by the use of automated collection systems, with a weighted mean score of 3.91 and an RII of 0.782. The design and introduction of eco-friendly automobiles ranked third, with a weighted mean score of 3.89 and an RII of 0.778. Reusing car parts and materials and industrial composting ranked fifth and fourth, respectively, with weighted mean scores of 3.80 and 3.82, and RII values of 0.760 and 0.764. The results suggest that recycling and automation are the most preferred solutions for managing automobile waste in the study area, while the donation of automotive waste to charities and local workshops and the introduction of eco-friendly automobiles are also considered viable options.

4.9 Tests for Hypothesis

Null Hypothesis H_{01}: There is no statistically significant relationship between sources of Automobile waste in Kwara State and its impact on the environment and public health.

Table 4.9 Model Summary of Automobile waste Sources in Kwara State and its impact on the environment and public health

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.752[a]	.566	.560	.69518

a. Predictors: (Constant), Automobile Wastes Impact on the environment and public health

Table 4.9 shows a model summary of the results of a linear regression analysis with one predictor variable and a constant term. The predictor variable is "Automobile Wastes Impact on the environment and public health," and the sources of automobile waste sources. The coefficient of determination (R-squared) for the model is 0.566, which means that 56.6% of the variation in the response variable can be explained by the predictor variable and the constant term. The adjusted R-squared value, which considers the number of predictor variables in the model, is 0.560. The coefficient of the predictor variable is 0.752, indicating a positive relationship between the predictor and response variables. The standard error of the estimate is 0.69518, which is the average distance that the actual values fall from the predicted values.

Table 10 ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	45.366	1	45.366	93.873	.000[b]
	Residual	34.796	72	.483		
	Total	80.162	73			

a. Dependent Variable: Automobile waste sources

b. Predictors: (Constant), Automobile wastes impact on the environment and public health

The ANOVA Table 10 summarizes the results of a hypothesis test for the significance of the regression model. The null hypothesis (H_{01}) is that there is no statistically significant relationship between sources of automobile waste in Kwara State and its impact on the

environment and public health. The ANOVA Table 10 shows that the regression model has a significant effect, as the F-statistic is 93.873 and the p-value is 0.000 (significance level of 0.05). This means that we can reject the null hypothesis and conclude that there is a statistically significant relationship between the predictor variable "Automobile Wastes Impact on the environment and public health" and the dependent variable "Automobile waste sources" in Kwara State.

The sum of squares for the regression is 45.366, indicating that the predictor variable explains a significant amount of the variation in the dependent variable. The residual sum of squares is 34.796, which is the variation in the dependent variable that is not explained by the predictor variable. The total sum of squares is 80.162, which is the total variation in the dependent variable. These results suggest that the predictor variable is a significant factor in explaining the sources of automobile waste in Kwara State, and that its impact on the environment and public health should be considered in efforts to address this issue.

Table 11 Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.766	.287		2.671	.009
	Automobile wastes impact on the environment and public health	.730	.075	.752	9.689	.000

a. Dependent Variable: Automobile waste sources

The coefficients Table 11 summarizes the estimated regression coefficients for the model, including the intercept and the coefficient for the predictor variable "Automobile Wastes Impact on the environment and public health". The intercept coefficient is 0.766, indicating that the expected value of the dependent variable "Automobile waste sources" is 0.766 when the predictor variable is 0. This intercept is statistically significant at a significance level of 0.05, with a t-value of 2.671 and a p-value of 0.009. The coefficient for the predictor variable is 0.730, which indicates that for every one-unit increase in the predictor variable "Automobile

Wastes Impact on the environment and public health," we would expect an increase of 0.73 in the dependent variable "Automobile waste sources" in Kwara State. This coefficient is also statistically significant at a significance level of 0.05, with a t-value of 9.689 and a p-value of 0.000.

The standardized coefficient (Beta) for the predictor variable is 0.752, which is the same as the coefficient of determination (R-squared) in the model summary. This indicates that the predictor variable has a strong positive effect on the dependent variable, after controlling for the intercept. These coefficients hence, suggest that the predictor variable "Automobile Wastes Impact on the environment and public health" is a significant predictor of the sources of automobile waste in Kwara State, and that efforts to mitigate the impact of automobile waste on the environment and public health could lead to a reduction in the sources of such waste.

Alternatively, the output in Table 4.11 shows the results of fitting linear regression model to describe the relationship Automobile wastes impact on the environment and public health and Automobile waste sources. The equation of the fitted model derived from the output is:

Automobile waste sources = 0.766+ 0.730 (Automobile wastes impact on the environment and public health) …...…Eqn.1

Ho was tested using the simple regression analysis. The simple regression model can be conceptualized as:

$Y = \beta_0 + \beta_1 (X_1) + e$

Where: Y = Dependent variable (passengers' satisfaction)

β_0 = Constant

β_1 = Regression coefficient of variable X_1

X_1 = Independent variable (service quality)

e = residual error

$Y = 0.766 + 0.730 (X_1)$

The interpretation to the above equation is that the slope of the regression line is significantly greater than zero, indicating that Automobile waste sources tends to increase as the underlying factor increases. The equation also shows that the Automobile waste sources will be 7.66%

when Automobile wastes impact on the environment and public health is zero. These results indicate that Automobile wastes impact on the environment and public health (β = 0.730, p = 0.000) have a significant effect on Automobile waste sources.

Null Hypothesis H_{02}:: There is no statistically significant relationship between the strategies for managing Automobile waste in Kwara State and mitigation of the environmental and public health impacts of the waste.

Table 4.12 Model Summary for the strategies for managing automobile waste in Kwara State and mitigation of the environmental and public health impacts of the waste

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.620[a]	.384	.376	.75149

a. Predictors: (Constant), Automobile wastes impact on the environment and public health

The model summary shows the results of a linear regression analysis with one predictor variable, "Automobile Wastes Impact on the environment and public health", and a constant term. The coefficient of determination (R-squared) for the model is 0.384, which means that 38.4% of the variation in the dependent variable can be explained by the predictor variable and the constant term. The adjusted R-squared value, which considers the number of predictor variables in the model, is 0.376. The coefficient of the predictor variable is 0.620, indicating a positive relationship between the predictor and the dependent variable. The standard error of the estimate is 0.75149, which is the average distance that the actual values fall from the predicted values.

Table 4.13 ANOVA[A]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	25.376	1	25.376	44.934	.000[b]
	Residual	40.662	72	.565		
	Total	66.038	73			

a. Dependent Variable: Strategies for managing Automobile waste

b. Predictors: (Constant), Automobile wastes impact on the environment and public health

The ANOVA table shows the results of the analysis of variance for the linear regression model with one predictor variable, "Automobile Wastes Impact on the environment and public health", and a constant term, predicting the dependent variable "Strategies for managing Automobile waste" in Kwara State. The table shows that the regression model accounts for a significant amount of the variation in the dependent variable, with a regression sum of squares of 25.376 and a corresponding F-statistic of 44.934. The p-value associated with the F-statistic is less than 0.001 (0.000b), indicating strong evidence against the null hypothesis that there is no relationship between the predictor variable and the dependent variable. The residual sum of squares is 40.662, which represents the unexplained variation in the dependent variable that is not accounted for by the predictor variable and the constant term. The total sum of squares is 66.038, which represents the total variation in the dependent variable.

Therefore, we can reject the null hypothesis that there is no statistically significant relationship between the strategies for managing Automobile waste in Kwara State and mitigation of the environmental and public health impacts of the waste. The results suggest that the predictor variable "Automobile Wastes Impact on the environment and public health" is a significant predictor of the strategies for managing Automobile waste in Kwara State.

Table 4.14 Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.864	.310		6.011	.000
	Automobile wastes impact on the environment and public health	.546	.081	.620	6.703	.000

a. Dependent Variable: Strategies for managing Automobile waste

The coefficients table shows the results of the linear regression analysis with one predictor variable, "Automobile Wastes Impact on the environment and public health", and a constant term, predicting the dependent variable "Strategies for managing Automobile waste" in Kwara

State. The table shows that the coefficient for the predictor variable is 0.546, with a standard error of 0.081. The standardized coefficient (beta) is 0.620, indicating a positive relationship between the predictor variable and the dependent variable.

The t-value associated with the predictor variable is 6.703, with a corresponding p-value of less than 0.001 (0.000), indicating that the predictor variable is statistically significant in predicting the dependent variable. The intercept coefficient is 1.864, indicating that the predicted value of the dependent variable when the predictor variable is zero is 1.864. The results hence, suggest that the predictor variable "Automobile Wastes Impact on the environment and public health" is a statistically significant predictor of the strategies for managing Automobile waste in Kwara State, with higher levels of impact on the environment and public health being associated with more effective strategies for managing the waste.

Alternatively, the output in Table 4.14 shows the results of fitting linear regression model to describe the relationship Automobile wastes impact on the environment and public health and Strategies for managing Automobile waste. The equation of the fitted model derived from the output is:

Strategies for managing Automobile waste = 1.864+ 0.546 (Automobile wastes impact on the environment and public health) …...…Eqn.1

Ho was tested using the simple regression analysis. The simple regression model can be conceptualized as:

$Y = \beta_0 + \beta_1 (X_1) + e$

Where:

Y = Dependent variable (passengers' satisfaction)

β_0 = Constant

β_1 = Regression coefficient of variable X_1

X_1 = Independent variable (service quality)

e = residual error

$Y = 1.864+ 0.546 (X_1)$

The interpretation to the above equation is that the slope of the regression line is significantly greater than zero, indicating that Strategies for managing Automobile tends to increase as the underlying factor increases. The equation also shows that the Strategies for managing Automobile waste will be 18.64% when Automobile wastes impact on the environment and public health is zero. These results indicate that Automobile wastes impact on the environment and public health (β = 0.546, p = 0.000) have a significant effect on Strategies for managing Automobile waste.

4.10 Findings of the study

The findings of this research is as follows; the active population is within the youth age group, it is observed that most of the respondents have attained tertiary levels in education, majority of respondents had a low level of automobile usage experience, majority of the respondents were undecided as per responses on the types of automobile waste in Kwara state, respondents were more certain that used oil, fuel, and other hazardous materials from vehicles are often disposed of improperly, and scrap yard operations contribute to the sources of automobile wastes in Ilorin, the respondents are aware of the environmental and health risks associated with automobile wastes and agree that measures should be taken to address these risks, from the findings recycling and automation are the most preferred solutions for managing automobile waste in the study area, while the donation of automotive waste to charities and local workshops and the introduction of eco-friendly automobiles are also considered viable options. From the test of Hypothesis, the findings show that there is a statistically significant relationship between sources of Automobile waste in Kwara State and its impact on the environment and public health and there is also statistically significant relationship between the strategies for managing Automobile waste in Kwara State and mitigation of the environmental and public health impacts of the waste.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary of the study

The aim of this research which was to evaluate the effects of automobile waste on the environmental and public health within Ilorin, Kwara state focused on identifying the origins and types of automobile waste in Kwara state, investigating the potential environmental and public health consequences associated with automobile waste in Kwara state, and exploring possible approaches to managing automobile waste in Kwara state. This was accomplished by conducting a comprehensive literature review and collecting secondary data via questionnaires. The research findings indicate that the active population mainly falls under the youth age group. Additionally, it was observed that a majority of the respondents had attained tertiary levels of education. However, most of them had low levels of automobile usage experience. When it comes to the types of automobile waste in Kwara state, the majority of the respondents were undecided. Nonetheless, they were more certain that used oil, fuel, and other hazardous materials from vehicles are often disposed of improperly. Scrap yard operations were also found to contribute to the sources of automobile wastes in Ilorin. Interestingly, the respondents showed awareness of the environmental and health risks associated with automobile wastes. They agreed that measures should be taken to address these risks. From the findings, recycling and automation were identified as the most preferred solutions for managing automobile waste in the study area. The donation of automotive waste to charities and local workshops and the introduction of eco-friendly automobiles were also considered viable options. Based on the results of the Hypothesis test, it has been established that there is a significant correlation between the sources of Automobile waste in Kwara State and their adverse effects on the environment and public health. Additionally, the study found that there is a significant

relationship between the approaches employed in managing Automobile waste in Kwara State and the extent to which these strategies can mitigate the environmental and public health impacts of the waste.

5.2 Implication

This research has significant implications for policy, practice, and research. Firstly, it emphasizes the importance of raising public awareness and providing education on the hazards of incorrect disposal of automobile waste. This measure can reduce the risks associated with the waste and encourage the adoption of appropriate waste management practices. The study's findings reveal that the most preferred methods for managing automobile waste in the area are recycling and automation. This emphasizes the importance of investing in recycling technologies and implementing policies that promote the use of eco-friendly vehicles. Additionally, the study highlights the significant correlation between the sources of automobile waste and their impact on the environment and public health. Therefore, a comprehensive waste management approach that considers the entire lifecycle of automobiles is necessary, from production to disposal. Finally, the study serves as an essential foundation for future studies on automobile waste management in Kwara State and similar regions. It can act as a benchmark for monitoring progress in waste management and assessing the effectiveness of interventions aimed at mitigating the environmental and public health consequences of automobile waste.

5.3 Contribution to knowledge

The study contributes to knowledge by providing a comprehensive understanding of the sources, forms, environmental and public health impacts of automobile waste in Kwara State. The study also highlights the need for effective management strategies to mitigate the adverse effects of automobile waste on the environment and public health. Furthermore, the study identifies the preferred solutions for managing automobile waste in the study area, including

recycling and automation, donation of automotive waste to charities and local workshops, and the introduction of eco-friendly automobiles. This information can be useful for policymakers, waste management agencies, and stakeholders in designing effective strategies for managing automobile waste in Kwara State and other similar regions.

Additionally, the findings provide valuable insights into the attitudes and perceptions of the respondents towards automobile waste and its impact on the environment and public health. This information can be useful for creating awareness campaigns and educational programs aimed at promoting responsible automobile waste disposal practices among the public.

Finally, the study's statistical analysis provides evidence of a significant relationship between the sources of automobile waste, its impact on the environment and public health, and the strategies for managing the waste. This information can be useful for guiding future research and policymaking aimed at addressing the environmental and public health impacts of automobile waste in Kwara State and other regions with similar challenges

5.4 Conclusion

Based on the findings of the research, it can be concluded that there is a need for immediate action to manage automobile waste in Kwara State to mitigate the environmental and health risks associated with it. The active population, which consists mainly of young people with tertiary education, should be involved in the efforts to manage automobile waste. There is also a need to increase awareness about the types of automobile waste and the proper methods of disposal. The respondents in the study area are aware of the risks associated with automobile waste and agree that measures should be taken to address them. Recycling and automation are the most preferred solutions for managing automobile waste, while donating automotive waste to charities and local workshops, and introducing eco-friendly automobiles are also considered viable options. The study establishes a statistically significant relationship between sources of

automobile waste in Kwara State and their impact on the environment and public health. Similarly, there is also a statistically significant relationship between the strategies for managing automobile waste and mitigating the environmental and public health impacts of the waste. The research findings hence, provide valuable insights for policymakers, environmentalists, and other stakeholders in the automobile industry to take necessary steps to manage automobile waste effectively, minimize its impact on the environment and public health, and create a more sustainable future.

5.5 Recommendations

Based on the findings of this study on the assessment of environmental and public health impact of automobile wastes in Ilorin, Kwara State, the following recommendations are proposed:

1. There is a need for immediate action to manage automobile waste in Kwara State. This should involve all stakeholders in the automobile industry, policymakers, and environmentalists.
2. The active population, which consists mainly of young people with tertiary education, should be involved in the efforts to manage automobile waste. This will increase awareness and participation towards effective management.
3. There is a need to increase awareness about the types of automobile waste and the proper methods of disposal. This can be achieved through public campaigns, education, and outreach programs.
4. Recycling and automation are the most preferred solutions for managing automobile waste, while donating automotive waste to charities and local workshops, and introducing eco-friendly automobiles are also considered viable options. Efforts should be made to adopt these solutions.

5. The study establishes a statistically significant relationship between sources of automobile waste in Kwara State and their impact on the environment and public health. Similarly, there is also a statistically significant relationship between the strategies for managing automobile waste and mitigating the environmental and public health impacts of the waste. This should be considered in policymaking and other efforts to manage automobile waste.
6. Collaboration among stakeholders in the automobile industry, policymakers, and environmentalists is essential for effective management of automobile waste in Kwara State.

5.6 Suggestion for further studies

Based on the findings of the study, the following suggestions for further studies can be made:

1. An in-depth investigation into the sources of automobile waste in Kwara State to provide more specific information on the types of automobile waste and their quantities.
2. Effectiveness of current regulations and policies in Kwara State that address the management of automobile waste, with a focus on enforcement and compliance.
3. A comparative analysis of the environmental and health impacts of automobile waste in Kwara State and other states in Nigeria, to identify the variations and similarities in the impact of automobile waste across different regions of the country.
4. A study on the feasibility of implementing eco-friendly automobiles in Kwara State, including the availability and affordability of these vehicles, and the readiness of the infrastructure and support systems for their adoption.

5. A study on the economic benefits of managing automobile waste, including the potential for job creation, revenue generation, and the promotion of sustainable development

REFERENCE

Abam, F. I, Unachukwu, G. O., (2009). Vehicular emission and air quality standards in Nigeria. European Journal of Scientific Research. 34(4):550-560

Adie, G. U., Osibanjo, O. (2009). Assessment of soil-pollution by slag from an automobile battery manufacturing plant in Nigeria; Afr. J. Environ. Sci. Technol. 3(9): 239-250.

Ajayi, A. B., Dosunmu, O. O. (2002). Environmental hazards of importing used vehicles into Nigeria; Procedings of international symposium on environmental pollution control and waste management Tunis EPCOWM p. 521-532.

Ashfaq, A., Sharma, P. (2012). Environmental effects of air pollution and application of engineered methods to combat the problem. J Indust Pollut Control.

Auffhammer, M., Carson, R. (2008). Forecasting the path of China´s Co2 emissions using province-level information. Journal of Environmental Economics and Management, 55: pp. 229-247.

Benson, D. & Jordan, A., (2017). Environmental Governance. The International Encyclopedia of Geography 10.1002/9781118786352.wbieg0631.

Berstein, J. A., Alexis, N., Bacchus, H., Bernstein, I. L., Fritz, P. & Horner, E. (2008). The health effects of non-industrial indoor air pollution. The Journal of Allergy and Clinical Immunology. 121(3):585-591

Bindra, S. P., Waleed, A., Rajab A. & Jafrabady (2018). Automobile pollution control strategies: some case studies. https://www.researchgate.net/publication/323726528

Bull, A. (2003). Traffic Congestion the Problem and How to Deal with It. Santiago: Nationes Unidas, Cepal

Bureau of Transport and Regional Economics (2002). Greenhouse policy options for transport, Report No. 105, Canberra, Bureau of Transport and Regional Economics.

Bureau of Transport and Regional Economics (2002). Greenhouse policy options for transport, Report No. 105, Canberra, Bureau of Transport and Regional Economics.

Colloquium, Ipeaiyeda, A. R., Dawodu, M. (2008). Heavy metals contamination of topsoil and dispersion in the vicinities of reclaimed auto-repair workshops in Iwo Nigeria Bull Chem. Soc. Ethiopia 22(3): 339-348.

Dioka, C. E., Orisakwe, O. E., Adeniyi, F. A. & Meludu, S. C. (2004). Liver and Renal Function Tests in Artisans Occupationally Exposed to Lead in Mechanic Village in Nnewi, Nig. Int. J. Environ. Res. Public Health 1(1): 21-25.

Dockery DW, Pope CA 3rd, Xu X, Spengler JD, Ware JH, Fay ME, Ferris BG Jr, Speizer FE. (1993). An association between air pollution and mortality in six U.S. cities. N Engl J Med. 329(24):1753-9. doi: 10.1056/NEJM199312093292401. PMID: 8179653.

Dongzi, Z., Hampden, D., Kuhns, J. A., Gillies, Vicken, E., Scott, B., Alan W. & Gertler (2012). Analysis of the effectiveness of control measures to mitigate road dust emissions in a regional network. Transport research Journal, D-17, pp. 332-340.

Enikanselu, P. (2008). Geophysical Seismic Refraction and Uphole Survey Analysis of Weathered Layer Characteristics in the "Mono" Field, North Western Niger Delta, Nigeria. Pacific J. Sci. Technol. 539(9): 2.

Eze, I. C., Schaffner, E., Fischer, E., Schikowski, T., Adam, M. & Imboden, M. (2014). Long-term air pollution exposure and diabetes in a population-based Swiss cohort. Environ Int. 70 :95–105. 10.1016/j.envint.2014.05.014.

Fakayode, S. O., Onianwa, P. C. (2002). Heavy metal contamination of soil, and bioaccumulation in Guineagrass (Panicum maximum) around Ikeja Industrial Estate, Lagos, Nigeria; Environ. Geol. 43: 145-150.

Federal Republic of Nigeria FRN (2006): 2006 Population Census". Archived from the original (PDF) on 5 March 2012. Retrieved 25 July 2016.

Gail, M. S., Anthony, R. A. (2013). Analyzing and Interpreting Data from Likert-Type Scales. Journal of graduate medical education 5(4): 541–542. doi: 10.4300/JGME-5-4-18

Guarnieri, M., Balmes, J. R. (2014). Outdoor air pollution and asthma. Lancet 383:1581–92. doi: 10.1016/S0140-6736(14)60617-6

Genc, S., Zadeoglulari, Z., Fuss, S. H. & Genc K. (2012). The adverse effects of air pollution on the nervous system. J Toxicol. doi: 10.1155/2012/782462

Guo, Y., Zeng, H., Zheng, R., Li, S., Pereira, G. & Liu, Q. (2017). The burden of lung cancer mortality attributable to fine particles in China. Total Environ Sci. 579:1460–6. 10.1016/j.scitotenv.2016.11.147

Harish, M. (2012). A study on air pollution by automobiles in Bangalore city management research and practice. Vol. 4 Issue 3 pp: 25-36

Hashim, D., Boffetta P. (2014). Occupational and environmental exposures and cancers in developing countries. Ann Glob Health. 80:393–411. 10.1016/j.aogh.2014.10.002

Holman-Dodds, J. K., Bradley, A. A. & Potter, K. W. (2003). "Evaluation of hydrologic benefits of infiltration based urban storm water management." J. Am. Water Resour. Assoc. 391: 205-215.

Igbozuruike, C. W. I., Opara-Nadi, A. O. & Okorie, I. K. (2009). Concentrations of Heavy Metals in Soil and Cassava Plant on Sewage Sludge Dump; UC Davis, the Proceedings of the International Plant Nutrition Colloquium XVI, Int. Plant Nutri.

Jiang, X-Q., Mei, X-D. & Feng, D. (2016). Air pollution and chronic airway diseases: what should people know and do? J Thorac Dis. 8: E31–40.

Joseph, O., Muhammed, Y., Raji, A. & Joseph, A. A. (2016). Utilization of Herbal Medicine Among Inhabitants of an Urban Centre in North-Central Nigeria. Algerian Journal of Natural Products Utilization of Herbal Medicine Among Inhabitants of an Urban

Kan, H., Chen, R. & Tong, S. (2012). Ambient air pollution, climate change, and population health in China. Environ Int. 42:10–9. 10.1016/j.envint.2011.03.003

Kassomenos, P., Kelessis, A., Petrakakis, M., Zoumakis, N., Christides, T. & Paschalidou, A. K. (2012). Air Quality assessment in a heavily-polluted urban Mediterranean environment through Air Quality indices. Ecol Indic. 18:259–68. 10.1016/j.ecolind.2011.11.021

Kate, M., 2011. Auto Troubleshooting: What's Leaking from My Car? [online]. The Art of Manliness. Available from: https://www.artofmanliness.com/skills/manly-know-how/car-leaks/ [Accessed 5 Dec 2022].

Kaun, A., & Uldam, J. (2018). Digital activism: After the hype. New Media & Society, 20, 2099 - 2106.

Kelishadi, R., Poursafa, P. (2010). Air pollution and non-respiratory health hazards for children. Arch Med Sci. 6:483–95. 10.5114/aoms.2010.14458

Langham, M. (2015). A Theoretical Framework for Viewing Pollution Problems. Journal of Agricultural and Applied Economics, 3(1), 1-8. doi:10.1017/S0081305200010050

Manucci, P. M., Franchini, M. (2017). Health effects of ambient air pollution in developing countries. Int J Environ Res Public Health. 14:1048 10.3390/ijerph14091048

Marlon JR, Bloodhart B, Ballew MT, Rolfe-Redding J, Roser-Renouf C, Leiserowitz A and Maibach E (2019) How Hope and Doubt Affect Climate Change Mobilization. Front. Commun. 4:20. doi: 10.3389/fcomm.2019.00020

Mazumder, G. (2008). Chronic arsenic toxicity and human health. The Indian Journal of Medical Research. 128:436-447

Moores, F. C. (2009). Climate change and air pollution: exploring the synergies and potential for mitigation in industrializing countries. Sustainability.1:43–54. 10.3390/su1010043

Nduka, J. K., Amuka, J. O. & Sale, J. F. (2015). Health risk assessment of environmental lead exposures through scrapped car paint dusts from fairly used car painting workshops in Nigeria. International Journal of Medical and Biological Frontier. 21(2):163-187

Nduka, J. K., Kelle, I. J. & Amuka, J. O. (2019). Health risk assessment of cadmium, chromium and nickel from car paint dust from used automobiles at auto-panel workshop in Nigeria. Toxicology Reports. 6:449-456. DOI: 10.1016/j. toxrep. 2019.05.007

NEPIS (National Service Center for Environmental Publications), (2017). US EPA (Environmental Protection Agency) Available online at: https://www.epa.gov/clean-air-act-overview/air-pollution-current-and-future-challenges (accessed August 15, 2017).

Nwachukwu, M. A., Feng, H. & Achilike, O. (2010). Integrated studies for automobile waste management and environmentally friendly mechanic villages in the Imo River basin, Nigeria. African Journal of Environmental Science and Technology. 4(4):234-249

Oyetola, O. O., Ayodele O. O. (2021). "Agricultural engineering profession: The perspective of employers at labour in Ilorin, Nigeria". AgricEngInt: CIGR: CIGR Journal Open Access. 23: 168–177 – via CIGR Journal Open Access.

Purdy, K. W. (2018). King of the road and motorcars of the golden past. Britannica publication vol 3

Sabine, L., Brian S. E. (2004). A handbook of statistical analyses using SPS. ISBN 1-58488-369-3 (alk. paper)

Schwela, D. H., Köth-Jahr, I. (1994). Leitfaden für die Aufstellung von Luftreinhaltepläne [Guidelines for the Implementation of Clean Air Implementation Plans]. Landesumweltamt des Landes Nordrhein Westfalen. State Environmental Service of the State of North Rhine-Westphalia.

Shah, V., Sivitanides, M., & Mehta, M.R. (2013). The era of digital activism. Int. J. Inf. Technol. Commun. Convergence, 2, 295-307.

Sharma, C., Pundir, R. (2008). Inventory of greenhouse gases and other pollutants from the transport sector Delhi. Iranian Journal of Environmental Health Science Engineering 5(2), pp. 117-124.

Spiegel, J., Maystre, L.Y. (2019). Environmental Pollution Control, Part VII - The Environment, Chapter 55, Encyclopedia of Occupational Health and Safety. Available online at: http://www.ilocis.org/documents/chpt55e.htm.

The World Gazetteer (2013). Ilorin, Nigeria". Archived from the original on February 9, 2013. Retrieved 18 February 2007

USEPA, (2011). Potential Changes in Emissions Due to Improvements in Travel Efficiency, U.S. Environmental Protection Agency (www.epa.gov); at www.epa.gov/otaq/stateresources/policy/420r11003.pdf

USGCRP (2009) Global Climate Change Impacts in the United States. In: Karl, T.R., Melillo, J.M. and Peterson, T.C., Eds., United States Global Change Research Program, Cambridge University Press, New York.

WHO, (2016). Air quality standards under the Air Quality Directive, and WHO air quality guidelines. Journal of European environment agency

WHO, (2018). First WHO Global Conference on Air Pollution and Health. https://www.who.int/airpollution/events/conference/en/

WHO, (2019). Air Pollution. Available online at: http://www.who.int/airpollution/en/ (accessed October 5, 2019).

Yamane, T. (1967). Statistics, An Introductory Analysis, 2nd Ed., New York: Harper and Row

Yasin, S., Iqbal, T., Arshad, Z., Rustam, M. & Zafar M., (2012). Environmental pollution from automobile vehicle service stations Journal of Quality and Technology Management Volume VIII, Issue I, June 2012, Page 61 – 70

APPENDIX 1

QUESTIONNARE

ASSESSMENT OF ENVIRONMENTAL AND PUBLIC HEALTH IMPACT OF AUTOMOBLIE WASTES IN ILORIN KWARA STATE

I'm Adebayo Simeon Anuoluwa a student of Federal University of Technology Minna. I am currently working on a research project with the topic stated above. This research is being carried out to get the perception of people who might have resided in Ilorin on the environmental and public health impact of automobile waste at any point and not necessary at the moment. All information provided will be completely confidential.

SECTION A

PERSONAL DATA

	PERSONAL DATA	Please indicate with a tick on the boxes			
	Gender	Male ⬭		Female ⬭	
	Occupation	Student ⬭	Civil servant ⬭	Automobile mechanic ⬭	Trader/ Business person ⬭
	Years of Automobile usage/ Experience	Less than 5 years ⬭	5-10 Years ⬭	10-15 years ⬭	15 years and above ⬭

SECTION B

INSTRUCTION: Please tick for the correct answer provided in the boxes below.

Indicate your level of agreement with the following sentences:

(1) Strongly disagree (2) Disagree (3) Undecided (4) Agree (5) Strongly agree

	TYPES OF AUTOMOBILE WASTE IN ILORIN KWARA STATE	1	2	3	4	5
	Car Parts such as tires, oil filters, glass, plastic, and metal.					
	Automotive Fluids such as Motor oil, brake fluid, transmission fluid, and other automotive fluids					
	Automotive batteries and coolants					
	Fluorescent Bulbs					

	SOURCES OF AUTOMOBILE WASTE	1	2	3	4	5
	Manufacturing plants					
	Automotive repair shops					
	Used oil, fuel and other hazardous materials from vehicles are often disposed of improperly					
	Scrap yard operations					

	ENVIRONMENTAL AND HEALTH RISKS ASSOCIATED WITH AUTOMOBILE WASTE	1	2	3	4	5
	Respiratory diseases as a result of Toxic Fumes from cars which may contain toxins such as carbon monoxide					
	Air pollution which can lead to respiratory illnesses such as asthma and bronchitis.					
	Ground Water Contamination as a result of automobile fluids, such as oil and antifreeze released to the ground					
	Soil Contamination as a result of heavy metals leaching into the soil and affecting local flora and fauna					
	Cancer as a result of release from automobile exhaust which may contain a variety of carcinogens					
	Lead Poisoning as a result of Lead released from car batteries					
	Faulty car parts or spilled fuels can lead to the risk of fire or explosions					

	POTENTIAL SOLUTIONS AND TECHNOLOGIES FOR MANAGING AUTOMOBILE WASTE (DISPOSAL PRACTICES)	1	2	3	4	5
	Recycling automotive parts and materials is a great way to reduce waste and preserve resources					
	Reusing car parts and materials					
	Automotive waste donation to charities or local workshops					
	Design and introduction of Eco-friendly automobiles to reduce carbon emissions and improve fuel efficiency					
	Use of Automated collection systems designed to collect and process automobile waste					
	Industrial Composting - a process in which automotive waste is broken down and converted into compost					