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Urban Growth and the Conflicting Roles of Automobile Workshops in Akure, Nigeria

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***Abstract*: Like most Nigerian urban centres, Akure has witnessed a rapid increase in population in recent years, culminating in the soaring number of vehicles on its roads. This phenomenon has led to problems with indiscriminately locating automobile workshops (AWs) in the city. This study, therefore, examines the most affected area of Akure, which sprawled over four political wards with 3,060 residential buildings within a 350 metres radius of Automobile Workshops owned by 511 registered mechanics. Twenty percent (20%) of the Automobile mechanics were randomly selected for data collection. The results revealed that the majority of AWs were located on the setback to roads and under high voltage power transmission lines within residential neigbourhoods where their operations generate wastes with diverse effects on the environment. This paper recommends the relocation of all the illegal automobile workshops that encroached on the identified spaces to a well-planned mechanic village to attain a sustainable living environment.**

***Keywords*: Automobile workshops, Residential area, Urban development, Environmental condition, Akure.**

1. Introduction

Urbanization is the process by which the urban population increases in absolute number and in proportion to the rural population (Koomen et al*.,* 2023) or simply a process of population concentration (Bilsborrow and Geores, 2023). Presently, Nigeria is experiencing its fair share of urbanization (Seun et al*.,* 2022) and accommodates urban areas with the lowest livability index in the world (Ekhaese and Asinobi, 2023). As a developing country, its urban areas are overwhelmed by environmental problems associated with urbanization (Ezeudu and Chukwudubem, 2023), hence, shabby states and unsanitary conditions resulting in an unpleasant living urban environment (Sou and Howarth, 2023).

The world's population is increasingly concentrated in urban settlements, presenting both opportunities for and challenges to sustainable development (Blasi et al*.,* 2022). These urban centers act as economic and social development hubs of commerce, transportation, communication, and government (Agunbiade et al*.,* 2021). They also promote technological growth and the use of automobiles worldwide as their populations explode. The world population of about 1 billion in the year 1800 rose to 7.7 billion in the year 2019 **(**Roser et al*.,* 2019). The world's population is projected to exceed 8.5 billion in 2030, 9.7 billion in 2050, and 11.1 billion by 2100 respectively (International Programs Center at the U.S., Census Bureau, Population Division, International Programs Center at the U.S., 2019.) the global vehicle fleet grows steadily with projections suggesting that by 2038, vehicles around the world will have exceeded 2.2 billion, compared with 1.31 billion in 2020 (EIA, 2021).

Nigeria has witnessed rapid growth in vehicle ownership for the past decades (Ukonze et al*.,* 2020). The nation's stock of vehicles was about 6.6 million units in 2010; it increased to 9.8 million and 10.6 million vehicles in 2015 and 2016, respectively (National Bureau of Statistics, 2016). The number of vehicles was reported to have increased by 72.4% in 2017, showing the country spending about N600 billion annually on vehicle importations. Based on this percentage, about 700,000 used vehicles were imported into the country annually (Bwatanglang et al., 2019). As revealed by Bamiro and Osibanjo (2004), the data from the Federal Road Safety Commission (FRSC) had put the total number of vehicles registered in Nigeria between January 1999 and July 2004 at 5,828,900 units. By the end of 2019, the number of vehicles plying the Nigerian roads was estimated at 11.7 million (Bwatanglang et al., 2019). This geometric increase in the number of automobile vehicles in Nigeria may have led to the corresponding increase in the number of Automobile Mechanic Workshops found in clusters in urban open spaces (Sambo et al., 2012).

Urbanization has enormous negative consequences in Nigeria, with its attendant population increase. Akure, like most Nigerian cities, has witnessed rapid growth in population in recent years, which has stimulated the acquisition of vehicles. As the state capital, the city performs several functions, ranging from commerce, education, social services, and recreation to administrative functions, thus prompting movement and interaction through road transport. The high level of usage of vehicles for both private and commercial activities, coupled with the inflow of second-hand vehicles popularly called *Tokunbo,* calls for very efficient and effective maintenance (Fapetu and Akinola, 2008) of the road transport system. As parts of these vehicles break down and wear out, they require maintenance (Tavares and Szpytko 2016), which is the reason

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why several automobile workshops (AWs) spring up all over the city to provide repair services close to the people.

Despite the overwhelming advantage of AWs, their heavy metal pollution of soil due to waste management is causing serious ecological and public health concerns (Nwachukwu, 2014). In Nigeria, pollution problems associated with incidents of oil spills and informal automobile workshops resulting in metal contamination have been the subjects of many reports (Ahmad et al., 2016). Utang et al. (2013) in their study in River State established that motor serving centres described here as automobile workshops are a source of automobile waste in many urban areas while Ekong et al. (2012) in similar research in Uyo reported that there is indiscriminate citing of AWs and disposal of hazardous waste such as brake fluid, greases, spilled oil, radiator coolant, soot, fuel, metal scraps, chemical, and other volatile compounds into the air and environment. They further establish that the chemical wastes of these AWs are not biodegradable and consequently persist.

As a metamorphosing city, Akure is developing all sectors to cope with its city challenges. In response to this development, AWs come into existence in Akure for the sole purpose of repairing and maintaining various types of Automobiles (Oloniyo and Basorun, 2016). The AWs are found in every available open space within the city, especially along traffic corridors. Many of these mechanic workshops are located on setbacks to the roads and under electricity power distribution lines, as well as on undeveloped or vacant land within the residential area. Ogundele et al., (2011) opined that the issue of controlling physical development in our urban settlements is crucial to the health of our cities. For instance, the siting of incompatible development based on either social, economic, or political factors is a serious threat to urban livelihood which be adequately addressed. While studies in the past, especially Utang et al (2013); Ekong et al (2012), and Nwachukwu (2014), limited their research to the assessment of automobile workshops' implications on soil in Rivers State, Akwa Ibon State, and Imo State, respectively. However, research efforts into automobile workshops have paid little attention to urban growth and the conflicting roles of automobile workshops in Nigerian cities, which is the focus of this study. The objectives study, therefore, are to: examine the location of automobile workshops; identify the type of services offered and major waste generated; and assess the distance of residential buildings to the workshops and their possible effects on the physical environment.

2. Literature Review

Urbanization is a process that transforms the physical and economic structures of towns and cities (Abubakar and Dano, 2018). Recently, the level of urbanization in developing countries has been unprecedented, with significant changes in its scale, rate, and shifting geographies (UN-Habitat, 2016). The process influences the growth of urban areas as centres for ideas, productivity, commerce, science, culture, and social development (Abubakar and Dano, 2018). Since 2015, more than half of the world population of 7.3 billion has been living in urban areas, and this is projected to reach around 68% of the estimated 9.7 billion global population in 2050 (Abubakar and Aina, 2019 and UNDESA, 2015). However, as the majority of people who migrated to urban areas with the hope of getting employment opportunities could not get jobs, the percentage of urban poor is growing faster than the total rate of urban population growth in Nigeria and other developing countries (UN-Habitat, 2016).

The informal sector of the economy was first "discovered" in the early 1970s (ILO 2002, Fox and Sekkel 2008). In 1972, the ILO suggested that the informal sector is "the non-structured sector that has emerged in the urban centres as a result of the modern sector's inability to absorb new entrants. Nigeria has the highest number of workers in the informal sector in Africa (Awojobi et al., 2014). The informal sector became prevalent after the Structural Adjustment Programme (SAP) was introduced in 1986. This attracted many workers in the formal sector as the majority of those retrenched found solace in informal sector employment, which appeared to be the immediate solution to the subsequent economic crisis (Oshinowo, 2007). According to Arosanyin et al. (2011), the informal sector plays a major role in the Nigerian economy because it creates employment and reduces the level of poverty. The attributes of the informal sector include the provision of employment in a variety of activities, such as battery repair, welding, vulcanizing, automobile mechanics, panel beating, and local manufacturing, among others. Remarkably, this sector is characterized by small-scale operations, labor-intensive techniques, low-income families, and private and indigenous ownership of enterprises that are largely unprotected by the government (Lawanson, 2011).

The informal sector in Akure is in no way different from another urban center informal economy in Nigeria, with over 70% of the population engaging in the economic sector. Automobile mechanics as an informal sector of the economy has been in existence for several decades in Akure for the sole purpose of repairing and maintaining various types of Automobiles (Oloniyo and Basorun, 2016). They operate mechanically with local/outdated tools of low quality because of their limited income. Vehicle engines are removed manually at the workshop instead of using a crane or hydraulic lift. In most places, service pits are not available, and where available, they lack reinforcement at the sides to hold loose sands in place (Fapetu and Akinola 2008). The advancement in technology has improved the mechanic's job to include electronic diagnosis. Many vehicles today possess complex computer and electronic systems that require broader knowledge of repair than in the past. The designs of vehicles have also become sophisticated as modern vehicles are being operated and controlled by computerized electronic sensors. Consequently, modern automobile mechanics opt for sophisticated diagnostic computers to enable them to diagnose vehicle engines and operate efficiently.

Various discussions on AWs and divergent views have emerged in literature (research papers, journals, and articles by different categories of academics, scholars, and professionals), each of which shows concern for the location and relocation of AWs within a residential neighbourhood. Different policy

papers on the location of AWs have also advocated for planning standards. Under this goal, the Ibadan Metropolitan Planning Authority (IMPA) made a move in 1985 to relocate the mechanics workshops and the service garages to the outskirts of Ibadan city, following petitions from members of the public about the immeasurable nuisance caused by the mechanics within the city.

Each automobile mechanic workshop hosts a variety of skills; mechanics, auto-electricians, battery repairers, vulcanizers, and panel beaters whose activities generate sundry waste with environmental implications. The waste products, such as engine oil, transmission oil, brake fluid, damaged tires, battery electrolyte, carbide, used batteries, and cells, are often recklessly disposed of, thus littering the surrounding areas, and much ends up in natural drainage channels (Adewoyin et al., 2013). The pollution effects of automobile repair activities in Nigeria have received limited attention despite the associated harmful waste production (Udebuani et al., 2011). This suggests the need to continually monitor their nature, volume, direct harmful effects, and current methods of disposal as well as potential impacts on the environment (Goudie 2018).

A. Environmental Implications of Automobile Workshops

The implications of automobile activities have been the subject of many reports and research that have been carried out in different parts of the country. Odoh et al. (2011) in their study on the assessment of trace metal pollution in automobile workshops in some selected local government Areas of Benue State, reveal that the pH of the soil samples tested is weakly acidic. The acidic nature of soil reflects the presence of heavy metals. Out of the heavy metals tested, lead (Pb) has the highest concentration with 513.00-582.00mg/kg. This is followed by Manganese (Mn) with 402.00-486.67kg, Copper (Cu) with 204.33-273.83, while other heavy metals such as Cadmium (Cd), Cobalt (Co), and Nickel (Ni) are traceably present.

Ipayeida et al. (2008) in their study of an automobile workshop in Iwo, Osun State, reported that the selected soil samples have Lead (Pb) as the abundant pollutant, and other heavy metals which are Nickel (Ni), Mercury (Hg), Chromium (Cr) and Zinc (Zn) are in trace percentages. Nwachukwu et al. 2010 in their Imo State study although like other researchers recorded a high concentration of Lead (Pb) with 99-1090 (±1076.8) but this occurrence is lesser than Iron (Fe) which is 7.48-70,606 (±23021) followed by Manganese (Mn) which is 186-600 (±49.7), Copper (Cu) which is 102-1001 (±4.2), Cadmium (Cd) which is 8-23 (±6.3), Chromium (Cr) 4-27 (±4.2) and Nickel (Ni) 3-10 (±2.2). Hence, the abundance order of heavy metals in their study area is Fe>Pb>Mn>Cu>Cd>Cr>Ni. This abundance record of Lead (Pb) pollutant stated by Nwachukwu et al. (2010) is not at variance with Ipayeida et al. (2008) record, which is Pb>Ni>Hg>Cr>Zn.

Ojiako and Okonkwo (2013) corroborated the aforementioned; they reported a high concentration of Lead (Pb), Copper (Cu), Nickel Ni, and Chromium (Cr) in the soil of a selected automobile workshop in Onisha, Anambra State. Also, Utang et al. (2012) reported the impact of automobile workshop artisans' activities in the Obio/Akpor Local Government Area of River State, with Lead (Pb) as the major pollutant, with a mean value of 1.03mg/kg. The mean result of an accumulation factor indicates that Pb, Cu, Cd, and Zn are the greatest contaminants in automobile workshops (Odoh et al., 2011). However, the concentration of such metals reduces with an increase in soil depth, a situation attributable to the bio-available phases of metals.

In water-related tests, Adewoyin et al. (2013) reported the influence of automobile workshop activities on soil and groundwater in the Ibadan metropolis when they discovered that the Dissolved Oxygen (DO) of 0.25-2.64mg/L which is less than the FEPA limit of 7.5mg/L, is obtainable in the area. Also, they recorded high grease and oil content of the water sample as well as a high concentration of Cadmium (Cd), which is beyond the FEPA limit. Ekong et al. 2012 in their air sample of Uyo, Akwa Ibom State, reported the presence of Sox (0.04-0.6ppm); NOx (0.1-0.5ppm), CO_2 (0.1-0.6ppm), and CO (0.01-0.7ppm). The concentration of these pollutants is higher than the World Health Organisation Standard.

From the foregoing, it is observable that Lead (Pb), Cadmium (Cd), Copper (Cu), and Zinc (Zn) are the major metal pollutants of automobile mechanic workshops. Meanwhile, these are fuel additives that are released during the combustion process or in fluid leakages, wear, engine oil, and corrosion of metals.

Table 1
Operations at the automobile workshop

S.No.	Activities	Environmental Impacts
1	Servicing vehicles and changing oil	Spilled used engine oil on the ground
2	Repair of transmission systems.	Spill used transmission oil on the ground.
3	Repair of fuel tanks.	Spill petrol and diesel on bare ground.
4	Repair or charging of batteries.	Spill the used electrolyte on the ground, and discard the battery casing and lead plates on bare ground.
5	Repair of braking systems.	Spill brake fluid on bare ground.
6	Repair of clutch systems.	Spill hydraulic fluid on the ground.
7	Overhauling of vehicle engines.	Discharge used oil and metal particles on the ground.
8	Panel beating of vehicle bodies, scraping of old body coats.	Metal bits, metallic coats, and dust on the ground.
9	Grinding, threading, wiring, etc.	Metal bits are filed onto bare ground. Waste wires, metals, and soldiers are dropped.
10	Greasing and oiling of parts.	Grease and oils spill on the ground.
11	Welding and soldering vehicle parts.	Litter carbide, solder, and an electrode on the ground.
12	Spray painting of vehicle bodies	Air pollution spills paint on the ground.
13	Washing of the potty fill of the vehicle body.	Washery on the ground, waste filler in the dumpsite.
14	Rainfall, Runoff, Stormwater	Roof dirt, Corrosion, Trace metals, Pollutants
15	Human waste	Deposited on the ground, no toilet facilities

Source: Nwachukwu et al. (2014) Concept and Design of Environmentally Friendly Automobile Mechanic Village

B. Planning and the Physical Environment

Planning tends to shape man's thoughts, actions, and attitudes towards the attainment of set goals. The social circle is seen as a social process that deals essentially with the improvement, provision, and ordering of the social needs of the citizenry of the environment (Osunsanmi, 2009). Land use planning, on the other hand, involves the development of land use issues, indicating appropriate development in areas of special environmental concern (Williams, 2000). Land use planning, as argued by Ogu (2010) has an impact on the efficiency of economic and social activities and also on the physical development of a city.

Land use planning is synonymously treated as physical planning because it attempts to achieve optimal spatial coordination of human activities to improve the quality of life. Physical planning generally allows reconciliation of land uses, provision of the right site for the right use, control of development, provision of facilities, services, and public goods, protection and conservation of resources, and preservation of heritage, among others (Oduwaye, 2009). It guarantees compatibility of land uses, and orderliness of development, and provides a functional and visually pleasing environment, and satisfactory services sustainably. Put succinctly, it is the spatial expression of the standard form of social and economic development, through which the 'ground rules' for sustainable development are established. Effective urban land control and management, particularly in the establishment of automobile workshops, is crucial to tackling problems of conflicting land uses, pollution, and environmental blight to ensure the safety of the environment and sustainable city development.

3. Materials and Methods

A. Research Locale

Akure is a traditional Nigerian city that became the provincial headquarters of Ondo Province, created in 1939. Akure Township is located in the Akure-South Local Government Area of Ondo State, Nigeria. It serves as the administrative capital of both Akure-South LGA and Ondo State. Akure is one of the fastest-growing urban settlements in the South-Western region of Nigeria. Over the years, the number of vehicles on its roads has increased greatly due to increasing socio-economic activities. Akure is located approximately 700 kilometers southwest of Abuja, the Federal Capital of Nigeria, and about 350 kilometers from Lagos (Oloniyo and Basorun, 2016). It lies at latitude 7^0 15^1 North of the Equator and at a longitude of 5^0 15^1 East of the Greenwich meridian. It shares geographical boundaries with Owo LGA, Akure North and Ifedore LGA, Ile-Oluji/Okeigbo LGA, and Idanre LGA.

B. Method

Given the large geographic coverage of the Akure metropolis, the scope of this study was limited to Gbogi/Isikan I, Gbogi/Isikan II, Oshodi/Isolo, and Owode/Imuagun political wards in Akure South LGA of Ondo State, where there is a high concentration of Automobile Workshops. The study employed the use of a questionnaire to examine the location of Automobile Workshops in the selected political wards. The Global Positioning System (GPS) device was employed to take the coordinates of all the AWs, while ArcGIS software was employed to synthesize and integrate different datasets. Five hundred and eleven (511) registered mechanics in the study area and three thousand and sixty (3,060) residential buildings within a 350-meter radius of Automobile Workshops were identified and used as sample frames. Using a systematic random sampling technique, 20% (102) of Automobile mechanics were systematically selected at every interval of 20 Automobile mechanics surveys in the study area. The methods of data analysis employed both bivariate statistics and univariate statistics. The univariate statistics were used to present the results in frequency percentage tables, charts, and the Relative Mean Index (RMI) appropriately about the data obtained with the questionnaires. Specifically, data collected through a 4-point Likert scale was analyzed descriptively by using the Sum of Weighted Values (SWV) to estimate the RMI for individual datasets. The RMI value for each variable was thus calculated by dividing SWV by the total number of responses, whereas the SWV for a variable is then calculated by adding the product of the number of responses to each aspect and the respective weight value attached to each rating (Fasina et al*.,* 2020).

The analysis is mathematically expressed as follows:

$$\text{SWV} = \sum_{i=1}^{4} Xi\,Yi \quad (1)$$

where:
SWV = Summation of Weight Value.
Xi = number of response rating i.
Yi = the assigned weight value (i = 1, 2, 3, 4).

$$\text{RMI} = \frac{\text{SWV}}{\sum_{i=1}^{4} i = Yi} \quad (2)$$

The bivariate statistics, on the other hand, employed Regression Analysis to determine the significant relationship between the distance of the residential building to the nearest AWs and the environmental implications of AWs operation in Akure. Data obtained from the research were analyzed using the computer Statistical Package for Social Science (SPSS IBM) version 21.

4. Results and Discussions

A. Location of the Automobile Workshops

Table 2
Location of automobile workshops

Location of AWs	Frequency	Percent
Under high voltage power transmission line	24	23.5
Setback to road	41	40.2
Open space	27	25.9
Within residential building	10	10.4
Total	**102**	**100.0**

Source: Author's Fieldwork, 2024

The irregular location of informal enterprises, coupled with

their haphazard development, is undoubtedly a major factor contributing to the deplorable condition of the urban physical environment (Abolade and Adeboyejo, 2013). The study revealed that 23.5% of the automobile workshops were located under high voltage power transmission lines, 40.2% along setbacks to the roads, 25.9% on open space, and 10.4% were situated within residential buildings. To make their workshops visible and accessible, most of the AWs are located on the road setback, which adversely obstructs the free flow of road traffic in the study area. This indicates the ineffectiveness and inadequacy of regulatory agencies controlling or coordinating the activities of automobile workshops in Akure (Oloniyo and Basorun, 2016). As observed by Okeke (2000), the infiltration of the informal sector has turned out to be an environmental problem, and its land use implications present a considerable challenge to urban land use planning in Nigeria.

Fig. 1. Akure L.G.A., Ondo State in the national setting

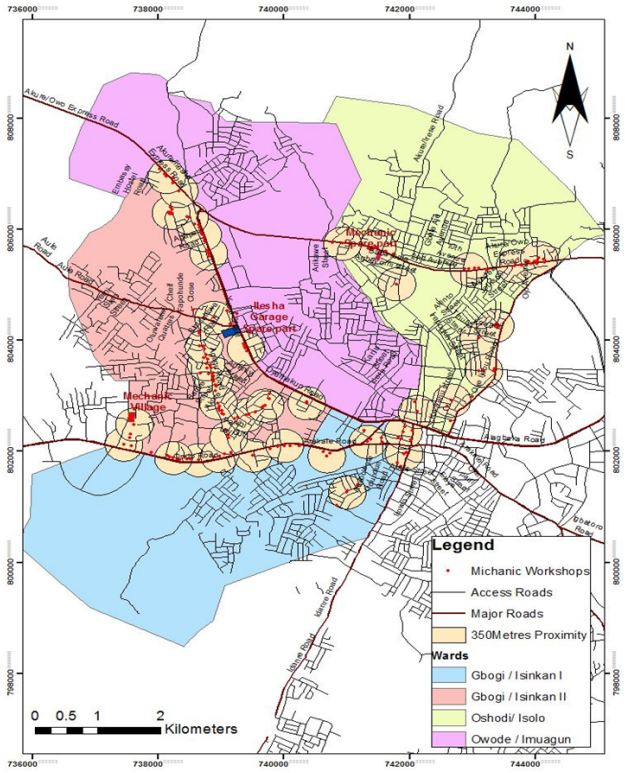

Fig. 2. Study area with location of automobile workshops within 350 metres radius of residential buildings

B. Categories of Waste Generated in Automobile Workshops and Type of Services Offered

Waste generation and disposal, especially from informal enterprises, is now one of the major environmental problems in Africa's urban areas (Onyenchere, 2011). The waste generated by automobile mechanics may include gasoline (petrol), diesel, used engine oil, and paints, among others (Nwachukwu et al., 2010). Categories of waste generated were examined from the perspectives of AW artisans in the study area. The data obtained was analysed on a 4-point Likert scale with gradation values consisting of Very High (VH = 4), High (H=3), Low (L=2), and Very Low (VL=1). Using "Eq. (1)" and "Eq. (2)", the SWV was estimated to be 21.2348 for the eight variables measured, while the RMI was 2.6543, with the detailed result presented in Table 3. Accordingly, spill engine oils, grease, and hydraulic fluid are the most disturbing issues associated with the workshops in the study area, as their relative index value of (3.4215) exceeds the mean index value (MIV) of the entire analysis. Also, scrap metal and vehicle parts are ranked second with MIV of (3.2450), while paint and spray materials (3.0686) are ranked third among the major wastes generated. In addition, abandoned vehicle carcass (2.9901) is another waste product that has substantial implications not only within the premises of the workshop but extending to the adjoining land, while used tires, rubber/plastic waste (2.8137) cannot be excluded among the nature of waste associated with RAWs in the study area. However, used electrolyte spills, discarded battery casing, lead plates (1.9019), and spilled petrol and diesel solvent wastes (1.4607) are other wastes associated with automobile workshops but of less significance. Unfortunately, the pollution effects of these automobile activities, which produce petroleum-based waste in Nigeria, have received limited attention (Pam et al., 2013).

While the information on the type of services offered at the automobile workshops showed that 64.7% of the AWs' operators were automobile mechanics, 27.5% were panel beaters and welders, and only very few (7.8%) were involved in spraying or painting vehicles and vulcanizing.

C. Distance of Residential Buildings to Automobile Workshops and Possible Environmental Implications in the Study Area

A Pollutant is a substance that occurs in the environment, at least in part, as a result of human activities, and which has a deleterious effect on the environment (Yu et al., 2011). The environmental implications of automobile workshop operations in Akure were examined from the perspectives of residents in the study area. The data was evaluated on a 4-point Likert scale with gradation values that consist of Strongly Agree (SA = 4), Agree (A = 3), Disagree (D = 2), and Strongly Disagree (SD = 1). In line with "Eq. (1)" and "Eq. (2)", Table 4 shows the detailed results of the analysis, in which the SWV and RMI estimated were 21.2089 and 2.6511, respectively, for the eight variables measured. The results of the analysis revealed encouragement of dirty environment (3.3398), encroachment of open space/landscape area (3.1209), loss of soil flora and green area (2.9771), encroachment of road setback/electricity power

Table 3
Categories of waste generated in AWS

Variables:	VL	L	H	VH	TWV	RMI	MIV	RK
Litter carbide, solder, electrode, and used wire	33	52	57	96	238	2.3333		6
Engine oils, grease, and hydraulic fluid spills	0	28	93	228	349	3.4215		1
Paint and spray materials	7	42	96	168	313	3.0686		3
Used tires, Rubber/plastic waste	12	52	99	124	287	2.8137		5
Used electrolyte spill, discarded battery casing, and lead plates	46	34	42	72	194	1.9019		7
Scrap metal and vehicle parts	0	48	87	196	331	3.2450		2
Spill petrol and diesel	44	38	72	60	149	1.4607		8
Abandoned vehicle carcass	9	44	96	156	305	2.9901	2.6543	4

Source: Authors' computation, 2024
Note: VL- Very Low, L- Low, H- High, VH- Very High, TWV- Total Weight Value, RMI -Relative Mean Index, MIV-Mean Index Value, RK- Rank

Table 4
Environmental implications of automobile workshops operations in Akure

Variables	SD	D	A	SA	TWV	RMI	MIV	RK
Encroachment of open space / landscape area	27	86	306	536	955	3.1209		2
Increases noise pollution	86	190	213	216	705	2.3039		6
Encourage dirty environment	3	72	363	584	1022	3.3398		1
Increase water contamination	94	294	120	100	608	1.9869		7
Loss of soil flora and green area	41	102	264	504	911	2.9771		3
Increases air pollution	15	268	285	248	816	2.6666		5
Increases the release of toxic compounds and greenhouse gases	143	162	177	92	574	1.8758		8
Encroachment of road setback / electricity power right of way	60	52	279	508	899	2.9379	2.6511	4

Source: Authors' computation, 2024
Note: SD- Strongly Disagree, D- Disagree, A- Agree, SA- Strongly Agree, TWV- Total Weight Value, RMI- Relative Mean Index, MIV-Mean Index Value, RK- Rank

right of way (2.9379) and increased air pollution (2.6666) as five (5) highly significant environmental variables of the automobile workshops operation in Akure. In a slight variation to the above results, it was also observed that increasing noise pollution (2.3039), increased water contamination (1.9869), and an increase in the release of toxic compounds and greenhouse gases (1.8758) are of less environmental consequence occasioned by the operations of automobile workshops in Akure. Also, the investigation of the distance between residential buildings and automobile workshops revealed that 20.3% were located less than 30 metres from the nearest automobile workshops; 38.2% between 30-60 metres; 19.6% between 61-90 metres, and 21.9% above 91 metres away. The majority (58.5%) of the residential buildings were located less than 60 meters from the nearest Automobile Workshops in the study area. Therefore, the effects of the automobile workshop operation on the residents will be pronounced due to its proximity.

D. Physical Condition of the Automobile Workshop Environment and Automobile Artisans' Perception of their Operations

Environmental degradation arising from indiscriminate disposal of waste and amorphous development of informal enterprises, among others, is a major characteristic of metropolitan cities in the world, especially in developing nations (Abolade and Adeboyejo, 2013). Except in relatively established automobile workshops, most workshops are characterized by temporary tents made of wood, and less care is given to the workshop itself. Virtually all (93.2%) of the automobile workshops sampled had several abandoned vehicle carcasses, thus creating an unsightly environment, while 6.9% had destroyed the surrounding landscape grasses. The appalling situation of AWs corroborates the finding of Ajah et al. (2015) that automobile mechanics dump untreated waste in their vicinity to cause environmental risk to humans, animals, and plants. This is probably because automobile mechanic activities in Nigeria are currently under the control of semi-literate individuals who hardly consider proper waste management. The operation of informal enterprises has defied urban land use planning and consequently defaced the urban landscape (Olajoke et al., 2013). This consequently results in environmental pollution and health hazards, filthy or unsanitary conditions of the environment. According to Deden (2007), there has been a constant conflict over the years between urban managers' efforts to keep their cities clean and informal economic operators who need space for informal activities.

Fig. 3. Physical condition of automobile workshop within residential environment

Furthermore, the analysis of artisans' perception of their operations regarding their environmental implications revealed that 38.1% of the artisans argued that their operations did not have negative impacts on the environment. Some of these respondents defended their viewpoint with the position that if their operation had environmental implications, such as years of usage should have grossly distorted the entire ecosystem. Some of the artisans who are situated within the residential

Table 5
Regression analysis model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.644[a]	0.415	0.399	0.81022

Table 6
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.562	.309		5.060	0.000
	Encroachment of open space/landscape area	-0.061	0.186	-0.056	-0.326	0.744
	Increases noise pollution	0.745	0.183	0.758	4.067	0.000
	Encourage dirty environment	-0.326	0.220	-0.225	-1.482	0.139
	Increase water contamination	-1.056	0.144	-0.885	-7.350	0.000
	Loss of soil flora and green area	0.598	0.227	0.605	2.635	0.009
	Increase vehicular emissions	0.262	0.181	0.214	1.448	0.149
	Increases the release of toxic compounds and greenhouse gases	0.294	0.140	0.275	2.101	0.036
	Encroachment of road setback	-0.170	0.199	-0.184	-0.853	0.394

a. Dependent Variable: Distance of the building to the nearest mechanic workshop
Source: Author's computation, 2024

building went further to stress that if they had negative effects on the neighbourhood where they were located, they could have been queried and expelled from such an environment. Over fifty-five percent (55.4%) of the artisans maintained that their activity had a negative environmental impact on the environment. They buttressed that evidence of the negative impact of their activities includes the non-survival of vegetation in engine oil-soaked workshops. This standpoint is, however, justified as it is observable that all the automobile workshops are characterized by engine oil soils. Meanwhile, 6.5% of these artisans remain indifferent to the issues.

E. Hypothesis Testing

H_o: There is no significant relationship between the distance of residential buildings to the automobile workshops and the environmental implications of the automobile workshops' operation

Table 5 reveals the results of regression analysis of the relationship between the distance of residential buildings and the environmental implications of automobile workshop operations in the study area. The F-ratio of ANOVA in the regression analysis reveals 26.295, and the calculated significant value is 0.000. In this study, the *P-value* (0.000) is less than $\propto = 0.05$, Hence null hypothesis was rejected, and the alternative hypothesis, which states that there is a significant relationship, was accepted.

The results also showed that out of the eight variables measured, four (4) variables (independent) best predicted the model. That is, increases noise pollution ($P = 0.000$), increases water contamination ($P = 0.000$), loss of soil flora and green area ($P = 0.009$), and increases the release of toxic compounds and greenhouse gases ($P = 0.036$) significantly determine and predict the distance of residential buildings to the nearest mechanic workshop in the study area (dependent variable).

The results of the analysis revealed noise pollution, water contamination, loss of soil flora and green area, and release of toxic compounds and greenhouse gases as pronounced environmental implications of AWs' operation in the residential environment. This may be due to the high concentration of AWs and their proximity to the residential building in the study area. Noise pollution is generated from the hitting and hammering of automobile parts and the revving of engines. The level of noise generated depends on the state of the engine, as more damaged engines produce more noise than fairly damaged ones. Also, air is being polluted from the chemical spray used in painting, while oil spills cause soil to lose its quality. With the sinking of automobile-related hydrocarbon into the soil, which travels down to the underground water level, it is expected that the water around the workshops will be smelly and hard. These activities, which involve the use of different chemical substances at the automobile workshops, are potentially dangerous both to the environment and to the health of human beings as well as animals (Adewoyin et al., 2013). No doubt, the land demand for automobile workshops is enormous, and their negative effects (noise pollution, water pollution, loss of soil flora and green area, and air pollution) are easily transmissible; hence, there is a need for sufficient setback between automobile workshops and adjoining land use.

5. Conclusion and Recommendation

Automobile workshops are centers of informal activity where automobile artisans of different specializations agglomerate in expectation of different complimenting jobs relating to automobile repair. There is an average of five complementing units (automobile experts) in automobile workshops in the study area. The number of units available in a given workshop is a function of the interrelationship between automobile artisans and the availability of space. Land encroachment of automobile artisans is evident as high proportions of the automobile workshops are built under power right-of-way and setback to the roads, with an untidy workshop environment. The choice of a location for an automobile workshop in the study is greatly determined by the accessibility and proximity to ancillary services (availability of automobile spare part shops). This study has established that automobile workshops are not only spatial units of informal agglomerations, but they also interact with their host environment. Such dynamic interactions have negative implications on the environment and residents of the area through the various waste generated. The increasing rate of indiscriminate location of automobile workshops in our cities today requires urgent planning intervention.

To prevent further environmental effects of AWs while

attaining sustainable physical development, the Ondo State Government should consider the development of additional Mechanic Villages (MVs) that will accommodate more automobile mechanics to prevent illegal operation of automobile workshops under high voltage power transmission lines and those along roads setback; Owners of the AWs should enjoy priority attention in the allocation of spaces at the proposed mechanic village to urgently resettle them for operation.

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