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AIR POLLUTION IN ZIMBABWE: AN ENVIRONMENTAL HEALTH CHALLENGE

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ABSTRACT

Air pollution is a major environmental problem in industrialized countries such as: the USA, China, Japan and most European countries including: France, Germany, Italy and the UK. One of its major causes is modern technology which depends heavily on fossil fuels (coal and oil) and dates back to the Industrial Revolution, which started some two centuries ago. Although the level of industrialization is quite low in developing countries such as Zimbabwe, air pollution is now posing a threat to the nation's environmental security. This paper examines the problem of air pollution in Zimbabwe with a view to suggesting possible solutions. While previous researches have given brief and rather superficial accounts on the problem, this paper seeks to provide an in-depth study on the issue for the benefit of researchers, stakeholders and policy makers. The paper examines issues such as: causes, sources, health impacts, and possible solutions within the legislative and policy framework of Zimbabwe.Based on information that was collected in August 2014, the paper shows that air pollution is a major environmental problem and should be addressed seriously at both local and national levels.

Key Words

Air pollution, sources/causes, legislation, environment, health, solutions

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INTRODUCTION

Since the beginning of the Industrial Revolution of the 19th century, environmental pollution has become a major problem which is confronting the world today (Miller, 1996). While as a natural process, pollution dates back to pre-historical times (Wellburn, 1994), during the past two centuries, it has escalated considerably due to the effects of human activities on our planet (WCED, 1991). Clark, (1990: 247) defines pollution as'the direct or indirect process by which any part of the environment is affected in such a way that it is made potentially or actually unhealthy, unsafe, impure or hazardous to the welfare of the organisms which live in it'. Apart from modern society's dependency on fossil fuels, air pollutions is also worsened by the disappearance of vegetation due to human activities such as: agriculture and urbanization. Katyal and Satake (2001, 15) define air pollutants as: '*Substances put into the air by the activity of mankind in concentrations sufficient to cause harmful effect to his health, vegetables, property or to interfere with the enjoyment of his property*'. They go further to list primary pollutants such as: carbon dioxide (CO2), carbon monoxide (CO), un-burnt hydrocarbons (HCs), sulphur dioxide (SO2) and nitrogen oxide (NO).

As air pollutants accumulate in the atmosphere they cause global warming, climate change, and ozone depletion (Miller, 1996). Although industrialized countries are the major causes/sources of air pollution, developing countries also contribute to the global environmental crisis even though at a much lower scale due to their lower levels of industrialization (Chenje and Johnson, 1994). Air pollution is a major threat to human health. According to a World Health Organization (WHO) report, in 2012 some 7 million people died due to exposure to air pollution (http:// www.who.int.mediacentre/releases/2014/air-pollution/en). Air pollution accounted for one in eight mortalities at the global level. This data has two implications. Firstly, it shows that air pollution is now one of the world's environmental health threats. Secondly, it is obvious that the reduction of air pollution has the potential to save millions of human lives at the global level especially in urbanized and industrialized regions.

The WHO report goes further to give a break-down of out-door and in-door air pollution-related deaths (Tables 1 and 2).

Table 1: Out-door air pollution-related deaths

Disease	% Deaths at global level
Ischaemic heart disease	40
Stroke	40
Chronic obstructive pulmonary disease (COPD)	11
Lung cancer	6
Acute lower respiratory infections in children	3
Total	100

Source: WHO Report (2014)

Table 2: In-door air pollution-related deaths

Disease	% Deaths at global level
Stroke	34
Ischaemic heart disease	26
Chronic obstructive pulmonary disease (COPD)	22
Acute lower respiratory infections in children	12
Lung cancer	6
Total	100

Source: WHO Report (2014)

The report also shows that 4.3 million people died due to exposure to house-hold caused or in-door-related air pollution while 2.7 million were accounted for by out-door caused air pollution. It has been estimated that at the global level, some 2.9 billion people use coal, wood or dung as primary cooking fuels (WHO Report, 2014). Most of these people live in developing countries which lack the capacity to develop and provide cleaner alternative sources of energy. This paper examines the problem of air pollution in Zimbabwe with a view to suggesting possible solutions. There is a general lack of scholarly literature on the subject of air pollution in Zimbabwe exceptfor Chipindu's five-page publication, which has been posted on the internet and discusses the status of air pollution in the country (https: //en.wikipedia.org/wiki/Health in Zimbabwe). Apart from this brief account, no serious effort has been made to study the problem of air pollution at the national level. For this reason some researchers have suggested that this information gap should be filled for the benefit of researchers, policy makers and other interested organisations (Mukute, Marange, Masara, Sisitka and Pesanayi, 2012).

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ENERGY DEMAND AND SUPPLY IN ZIMBABWE

Energy consumption in Zimbabwe reflects the country's dual economy which dates back to the colonial era (Chandiwana, 1996). A modern industrialized sector co-exists with a backward rural-based traditional economy. While the former heavily depends on coal, oil and electricity, the latter relies on woodfuel (Chenje and Johnson, 1994). According to Chandiwana (1996), in 1980 Zimbabwe's total energy consumption level was equivalent to about 5 874 million tonnes of coal. This could be broken down into specific categories (Table 3). The country's heavy dependency on coal, wood fuel and oil was a cause for concern as it had negative effects on the natural environment. Apart from causing air pollution (thereby leading to global warming and climate change), this scenario also encouraged deforestation in communal areas where the majority of people (up to 80%) lived (Nkala, 1996). It is ironical that some thirty years later, the situation had not changed significantly.

Table 3: Energy consumption in Zimbabwe at independence in 1980

Type of Energy	% Consumption
Coal	32.4
Hydro-electricity	29
Wood fuel	26.4
Petroleum fuels	11.2
Bagasse	2.6
Ethanol	0.2

Source: Chandiwana (1996, 88)

The country still depended heavily on fossil fuels (coal and oil) as well as wood fuel (Chimhowu, Manjengwa and Feresu, 2010). In communal areas the rate of deforestation had worsened as peasants tried to meet their daily energy needs through wood fuel.According to Chandiwana (1996, 89) this situation showed that Zimbabwe had not '*adequately dealt with the key issue of channeling investment flows to address the crisis of rural energy. As a result, the fuel wood sector poses the most glaring manifestations of an un-sustainable consumption of environmental capital, that is, biomass*'. Although Zimbabwe has the potential to develop enough electricity to meet all its needs, to date the country still depends on imports from Mozambique and Zambia (Chenje and Johnson, 1994). Obviously, this situation is un-sustainable in the long term. The country has not fully exploited cleaner sources of energy such as solar and wind which are abundant throughout the year (Mapira and Munthali, 2011).

From 1993 to 1996, the United Nations Development Programme (UNDP) teamed up with the Government of Zimbabwe (G.o.Z) in a rural electrification project which was aimed at installing 9 000 solar power systems. The project had two main objectives. Firstly, it sought to uplift the living standards of rural folks in the country. Secondly, it was geared at addressing the '*problem of global warming by offering an environmentally benign free solar energy resource*' (Chandiwana, 1996:107). In more recent years this project has been complemented by a nationwide rural electrification programme which has targeted schools, clinics, growth points and shopping centres (Chimhowu, et. al, 2010). The solar energy project gained momentum through the support of various stake holders such as: installers, consumers, manufacturers, finance houses, non-governmental organizations (NGOs), donors and district councils. Although most rural folks cannot afford solar power gadgets, the few who have adopted them now depend less on wood fuel for lighting and heating purposes. This is a positive development as it has the potential to reduce the rate of deforestation in the country in the long run.

There are two major sources of electricity in Zimbabwe, namely the Kariba hydro-electricity generating plant and thermal power stations which depend on coal (Table 4). Examples include: Bulawayo, Harare and Munyati thermal stations. While the Kariba plant is environmentally friendly, thermal power stations are major air polluters in the country. For this reason there is a need to increase the number of hydro-electric power plants in the country in order to reduce the dependency on thermally produced electricity which is a threat to the atmosphere. In the past, the Kariba plant alone has produced 50% of Zimbabwe's energy needs (Chandiwana, 1996). However, during drought periods such as the 1992 case, this figure has been reduced to precarious levels thereby threatening energy security in the country. For this reason, Zimbabwe cannot totally avoid partial dependency on thermal power plants. Major consumers of electricity in Zimbabwe are mines and industries. Examples of coal dependent industries are the Hwange thermal station and the Zimbabwe Iron and Steel Company (ZISCO) in Kwekwe.

Table 4: Existing Main Power Plants in Zimbabwe

Plant	Size (MW)	Type
Kariba South	666	Hydro power plant
Hwange	920	Thermal power plant
Bulawayo	120	II

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Munyati	120	II
Harare	135	II
Total	**1961**	

Source: Chandiwana (1996, 97)

RESEARCH METHODOLOGY

The information contained in this paper was derived from primary and secondary sources. Before the primary data was collected, a literature survey was conducted in order to establish the nature of the air pollution problem at local, national and global levels. The information gathered laid a theoretical foundation for the whole study. Some of the secondary sources perused included: textbooks, the internet, newspapers, magazines and some government documents and Acts. The literature survey was followed by the administration of a questionnaire which targeted ordinary people in various parts of Zimbabwe.This was done in August 2014. The questionnaire document sought for information such as: causes/sources, negative health impacts, and possible solutions to the problems of air pollution. The information collected was analyzed and it yielded the views which are expressed in this paper.

ZIMBABWE'S LAWS AND POLICYON AIR POLLUTION

Zimbabwe's laws on air pollution are enshrined in three government documents, namely: the Atmospheric Pollution Act (CAP 20: 03) of 1996, the Environmental Management Act (CAP 20: 27) of 2002, and the more recently promulgated Environmental Policy and Strategies of 2009 (G.o.Z, 2009). The Acts seek to control four types of air pollution, namely: noxious and offensive gases, smoke, dust and fumes from internal combustion engines. They also prescribe the penalties which should be meted out to offenders. The Acts specify air quality standards which should be maintained at all times. In 2007 the Government of Zimbabwe (G.o.Z) established an environmental management agency (EMA), which became a watch dog of the country's environment. EMA has the mandate to sue any person or organization that is guilty of polluting the environment. For example, the Environmental Management Act in Section 63 states that:

'Any person who emits any substances which cause substantial air pollution…in contravention of emission standards established under this Part shall be guilty of an offence and liable to imprisonment for a period of not more than five years or to a fine of not more than fifteen million (Zimbabwean) dollars or both such fine and such imprisonment' (G.o.Z. 2002: 379).

In addition, the offender has to pay the cost of removal of the pollution as well as the reclamation or restitution or compensation as determined by courts of law. However, a major problem is that EMA is under-funded, under-resourced, and under-staffed at national, provincial and district levels (Chimhowu, et.al, 2010). These problems limit the organization's capacity to execute its mandate. But this is not surprising as Zimbabwe has often been accused of lacking political will when it comes to environmental issues (Nkala, 1996). Zimbabwe's Environmental Policy came into operation in 2009 and it covers issues such as air, water, land, flora and fauna. Air pollution is more pronounced in urban centres than in rural areas (Chenje and Johnson, 1994). Air quality also varies from one season to another. Research shows that air quality deteriorates remarkably

'whenthermal inversions prevail, trapping particulates and noxious gases arising from motor vehicle exhaust fumes, industrial emissions, and both domestic fires and bush fires. Some of these air pollutants cause acute and chronic respiratory illnesses, particularly among the poor and the less privileged in society. Air pollution alsoadversely impacts the water, soils and vegetation on which people and wildlife depend. Acid rain corrodes materials and buildings, increasing maintenance costs, and reducing values. Green-house gas emissions may lead to weather modifications, and climate change' (G.O.Z, 2009: 3). Since air pollution does not respect political boundaries, Zimbabwe's environmental policy advocates international cooperation on air pollution prevention and control.

The guiding principle enshrined in the policy document is that every person has the right to clean air and a healthy environment. In order to achieve this goal several strategies are employed (G.o.Z, 2009). Firstly, there is an integrated strategy for the control and management of air quality at national level. It is the responsibility of the Standards Association of Zimbabwe (SAZ) to develop air quality standards for industry and other interested and affected parties. Secondly, any development projects which negatively affect air quality have to be subjected to environmental impact assessments (EIAs). Appropriate, preventive and mitigating measures should comply with an y environmental management plan (EMP). Thirdly, there are regulations which control gaseous and particulate emissions from point sources. Some are also aimed at discouraging widespread deforestation and encouraging afforestation so as to increase carbon storage in plants and soils. Fourthly, incentives are provided to industries which reduce air pollution in their operations. Measures are also in place to encourage the replacement of old motor vehicles and industrial plants which cause air pollution. This is facilitated through research efforts which are aimed at developing environmentally friendly technologies. Mechanisms are also in place to support the research and monitoring which are required to effectively control air pollution in the country. Finally, Zimbabwe cooperates with its neighbours in order to reduce air pollution through the promotion of cleaner energy sources such as solar, wind and water.

Although Zimbabwe's level of industrialization is quite low by global standards, air pollution poses a serious human health risk. A study recently conducted by Chipindu identifies two main sources of air pollution in the country, namely, natural and human-induced or anthropogenic (http: www.sei-international.org/rapidc/pdfs/ Air Pol Zim. PDF.The Status of Air Pollution

in Zimbabwe).The main human causes of air pollution in the country which he identifies include: transportation, industrial processes, industrial and non-industrial fugitive processes, energy production, waste management and agricultural activities. Most industries in Zimbabwe are located in urban centres such as Harare, Bulawayo, Gweru, Kwekwe and Mutare. They emit air pollutants like sulphur dioxide, Nitrogen oxide, carbon monoxide, methane and other organic compounds. Chipindu notes that compared to neighbouring Zambia, Zimbabwe has a higher level of air pollution mainly due to a much higher rate of individual car ownership. Furthermore, the majority of cars are: old, and lack air pollution prevention devices (catalytic converters). Chipindu's study also notes that thermal power stations and combustion engines are the main sources of air pollution in Zimbabwe. He suggests that the country's laws should be more stringent in dealing with them.

RESULTS AND DISCUSSION

This section presents and discusses the main results which were derived from the study. This includes: the main sources/causes of air pollution, and the negative impacts on both human and environmental health.

Main sources of air pollution in Zimbabwe

Information derived from the study identified numerous sources of air pollution in Zimbabwe. They are ranked in order of how frequently respondents mentioned them (Table 5). For example, manufacturing industries, sewage disposal works, motor vehicle exhausts and veldt fires rank highly on the table while steam engines, dust roads, and smoking are quite low. This information corroborates Chipindu's views on the main sources of air pollution in Zimbabwe (http: www.sei-international.org/rapidc/pdfs/ Air Pol Zim. PDF. The Status of Air Pollution in Zimbabwe). However, none of the respondents mentioned thermal power stations as major sources of air pollution. This is probably due to the fact that most thermal power stations which were established during the colonial eraare no longer functional. Only the Hwange power station has remained and is located in a remote part of the country. Hence most respondents had never seen it.

Table5: Main sources of air pollution in Zimbabwe

Sources	No.of Respondents/Frequency	Ranking
Manufacturing Industries	180	1
Sewage Disposal Works	120	2
Motor Vehicle	120	2
Veldt Fires	110	4
Bursting Sewage Pipes	71	5
Agricultural Activities	64	6
Household Heating Systems	52	7
Solid Waste Dump Sites	33	8
Steam Engines	32	9
Dust Roads	30	10
Smoking	23	11

Source: Questionnaire Survey

In the city of Masvingo, to the south eastern part of the country, respondents gave a somewhat similar picture (Table 6). While vehicle fumes, industries, sewage disposal in rivers, solid waste dump sites, veldt fires and bursting sewage pipes top the list, other activities such as the burning of household waste, construction works, the use of dust roads and public smoking are at the bottom of the table. The Masvingo case shows that although air pollution is dominant in all urban centres, each town or city exhibits some unique characteristics. For example, the Mucheke and Shagashe rivers which pass through the city are heavily polluted and pose a serious environmental threat to the city's residents (Mapira and Mungwini, 2005). In general air pollution is more pronounced in towns and cities than in rural areas. This is not surprising as manufacturing industries, sewage works and motor vehicles are concentrated in urban areas. This implies that urban dwellers are more exposed to air pollution than rural folks.

Frequent power cuts due to load shedding force urban residents to resort to wood fuel for heating and cooking (Chimhowu, et.al, 2010). However, rural people also experience air pollution problems due to veldt fires and the predominance of wood fuel as a source of energy (Chandiwana, 1996). Although rural electrification has been underway for more than a decade, its impact at the grass roots level is still quite low (Mukute,et.al, 2012). This is because it is confined to schools, health centres or clinics, growth points, district service centres, andshopping centres (Mapira, 2011c). Furthermore, most rural people cannot afford the cost of electricity as they lack regular sources of income. Hence they resort to wood fuel as the only source of energy that is available to them.

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Table 6: Sources of air pollution in Masvingo city

Sources	Number of respondents/Frequency	Ranking
Vehicle fumes	110	1
Sewage waste disposal in rivers	67	2
Industries	64	3
Solid waste dumpsites	53	4
Veldt fires	51	5
Bursting sewage pipes	48	6
Burning of solid waste	36	7
Construction works	29	8
Dust roads	24	9
Smoking	11	10

Source: Questionnaire Survey

Impacts of air pollution on human health

As mentioned previously, air pollution poses serious risks on human health (Katyal and Satake, 2001). In Harare (Zimbabwe), the WHO limit for sulphur dioxide (20 ug/m3 per day) has been exceeded by ten times (https://en.wikipedia.org/wiki/Health in Zimbabwe). Some of the negative effects of air pollution include: respiratory diseases (asthma, bronchitis, lung inflammation), lung cancer and some heart diseases (Wellburn, 1994). This study shows some of the negative impacts of air pollution in Zimbabwe (Table 7).While most of the impacts have negative implications on human health, others are a threat to the natural environment. Examples are damaged environments, stunted vegetation, global warming and climate change. The exposure of human beings to air pollution also raises morbidity levelsas shown by the prevalence of respiratory, lung and heart diseases. Ordinary people, employees and elderly citizens have to endure the negative impacts of air pollution on their health. Respiratory diseases force ordinary people to incur medical expenses which they can hardly afford. In rural areas, high morbidity rates reduce agricultural productivity.

Table 7: Impacts of air pollution on human healthin Zimbabwe

Health problem	Number of Respondents/ Frequency	Ranking
Respiratory diseases	178	1
Bad smells/odours	97	2
Reduced visibility	86	3
Eye sight problems	64	4
Global warming and climate change	64	4
Damaging the aesthetic value of environments	63	6
Irritation	57	7
Sore eyes	49	8
Skin diseases	44	9
Heart diseases	43	10
Acid rain	27	11
Stunted vegetation	23	12

Source: Questionnaire Survey

At other places of employment work performance is also reduced due to absenteeism, which is linked to these illnesses. Air polluted environments also endanger the health of vulnerable groups such as: the poor, children and the elderly who

spend much time in these places. Information collected from the survey shows that air pollution has negative impacts on the health of many ordinary people in Zimbabwe (Table 8). Respiratory problems, lung cancer and tuberculosis have been experienced in various settlements such as: Birchenough Bridge Growth Point, Chiredzi, Kwekwe, Masvingo and Triangle. Birchenough Bridge is a growth point whose main activities are irrigation schemes, bottle stores, general dealer shops and milling. There is also a hospital and a primary school in the vicinity. The main sources of air pollution are grinding mills and dust roads which are quite busy during day hours. Chiredzi and Triangle produce sugar cane which they process into sun-sweet (raw sugar) before railway transportferries it to Bulawayo and Harare for refining. When the cane is ready for harvesting, plantations areset on fire so as to get rid of the leaves. The resultant smoke together with that from sugar processing mills generates a lot of pollution.

Table 8: Air pollution-induced diseases in Zimbabwe

Settlement/town/city	Age of victim	Sex	Year	Health problem
Birchenogh Bridge	68	Male	2013	Tuberculosis
Chiredzi	62	Male	2012	Lung cancer
Kwekwe	15	Male	2012	Respiratory disorder
Masvingo	15	Male	2005	Breathing problem
Triangle	55	Male	2011	Breathing problem
Zvishavane	46	Male	1997	Asbestosis
Zvishavane	40	Male	2011	Lung cancer

Source: Questionnaire Survey

The city of Kwekwe is located along the Bulawayo-Harare highway, about 50 km from the city of Gweru.Lying in close proximity with the iron ore mining town of Redcliff, it is well known for the production of iron and steel whileits blast furnaces are notorious sources of air pollution (Munowenyu, 1997). Zvishavane, on the other hand, is an asbestos mining town which has exposed its employees to diseases such as lung cancer and asbestosis. It lies about 98 km to the south of Gweru and a similar distance from Masvingo. It is worth noting that all the victims of air pollution depicted on the table are male which implies that they are more exposed to air pollution than their female colleagues. However, women are likely to be more prone to the problem as they spend more time indoors and using coal and wood as sources of energy (WHO Report, 2014). Hence the data on the table should be read with caution as it may not reflect the situation at national level. It is possible that only those who were hospitalized for their conditions were recorded on the questionnaires. The rest including women and children who rely on coal and wood as heating systems were probably never recorded.

POSSIBLE SOLUTIONS TO THE PROBLEM OF AIR POLLUTION IN ZIMBABWE

Questionnaire respondents gave a wide range of possible solutions to the problem of air pollution in Zimbabwe including preventive and punitive measures, technological adjustments, recycling of waste materials and pollution awareness campaigns. Preventive measures are strategies aimed at curbing or reducing air pollution. They include the use of clean energy sources such as electricity which tend to reduce dependency on fossil fuels such as coal, wood and oil. However, since Zimbabwe is a developing country, it lacks the capacity to implement this solution in the near future. Compared to other sub-Saharan countries, its per capita energy consumption of fossil fuels is quite high (Chandiwana, 1996). The rural electrification programme which was launched a decade ago is not likely to yield major changes as it leaves many villagers, and rural communities un-served (Mukute, et. al, 2012).

Punitive measures include the imposition of fines and jail terms on polluters, increasing penalties on culprits, such as industries, institutions and some individuals. However, the effectiveness of these measures has been questioned in the past (Chandiwana, 1996). Furthermore, although EMA has employed punitive measures since its inception in 2007, there is no evidence of behavior change at the grass roots level (Mapira, 2012a). In rural areas veldt fires have been on the increase while in towns and citiesindustries continue to puff out clouds of smoke. Exhaust fumes from motor vehicles pose an environmental health challenge. On the other hand sewage bursts gush out raw effluent in some urban areas thereby releasing bad odours and smells (Mapira, 2011a). From these facts, it is obvious that other possible solutions should be considered. Technological re-adjustments are a good example which was suggested by questionnaire respondents. They would involve the development of energy sources which are environmentally friendly such as: solar, water and wind.

However, there is a need for a long term perspective on these alternatives since a lot of planning and financial resources would be required in order to implement them. This is because many industries in Zimbabwe still depend on fossil fuels, as mentioned previously. Hydro-electric power relies on the availability of perennial supplies of flowing water. But most rivers in the country have seasonal flow regimes which cannot guarantee constant water flow throughout the year. The construction of large dams would provide a solution if it were not for chronic droughts induced by the *El Nino*phenomenon (Chenje and Johnson, 1994). Although solar and wind energy are abundant in Zimbabwe, they have not yet been fully exploited due to the lack of funds (Mapira and Munthali, 2011). Respondents to the questionnaire also suggested the recycling of waste materials as an air pollution mitigation strategy. Instead of burning garbage and other forms of solid waste towns and cities can recycle them. In the city of Masvingo this solution has been suggested by an Italian company

which planned to establish a recycling factory using garbage drawn from Zimbabwe's urban centres (Mapira, 2011b). If this plan had succeeded, the problem of solid waste disposal would have been partly solved. However, to date no such development has occurred and residents continue to burn some of their wastes thereby polluting the air.

Respondents also suggested the use of educational awareness campaigns directed at members of the public. This is a logical remedy compared to the punitive measures which have proved to be ineffective over the years (Chandiwana, 1996). Environmental education (EE) has been applied in various parts of the world and yielded positive results in countries such as Australia, Canada and the UK (Palmer, 1998). However, providers of EE should be adequately funded if they have to be effective in their campaigns, something which is lacking in most SADC countries including Zimbabwe (Molapo, 1999). Aparthy towards environmental issues also prevails among top government officials such as cabinet ministers (Mapira, 2014). Corruption is also rampant among some EMA officials who solicit bribes from organizations and individuals who violate environmental crimes (Mapira, 2012a).In general the spirit of environmental stewardship is lacking at all levels of the social ladder as shown by veldt fire out breaks and the rampant poaching of wildlife resources such as elephants and rhinos (Mapira, 2014). Under such circumstances, EE campaigns are not likely to bear positive results.

The reduction of car ownership rates was also suggested as a possible solution. In 2007, there were114 cars per 1000 persons in Zimbabwe compared to only 17 in neighbouring Zambia (www.https.//en. Wikipedia. Org/wiki/Healthin Zimbabwe). Most of the cars in Zimbabwe are old and also lack catalytic convertors. Hence they are notorious for their high carbon emissions. For these reasons, Zimbabwe's levels of air pollution were much higher than those of Zambia. If individual car ownership rates could be reduced in Zimbabwe, more people would have to depend on public transport thereby reducing levels of air pollution in the country. However, the reduction of individual car ownership levels is not likely to occur in the near future since attitudes towards the environment take long to change as some researchers have shown (Fien, 1993). Some respondents suggested that the government of Zimbabwe should ban un-road-worthy motor vehicles from the roads. Efforts should also be made to speedily repair broken down sewage treatment plants so as to reduce the emission of bad odours and smells in urban environments. There is also a need to monitor carbon emissions in all industrial operations with a view to keeping them at safe levels. On the other hand, proper refuse disposal methods should be maintained in all towns and cities. Obviously, these solutions call for massive funding at both local and national levels, something which is lacking due to the ailing national economy (Mukute, et.al, 2012).

CONCLUSIONS

One of the major consequences of modern industrialization and urbanization has been that of environmental degradation at the global scale. This includes: land, water and air pollution at local and national levels (WCED, 1991). These problems have no easy solutions even though much effort has been directed at solving them over the last half century (Miller, 1996).Although air pollution is most pronounced in industrialized countries such as: the USA, China, Japan, India and most European countries, developing countries like Zimbabwe, in spite of their weak industrial bases, are also contributing significantly to the global problem. Air pollution is notorious for causing global warming and climate change, damaging natural ecosystems and human health. Although air pollution is due to both natural and anthropogenic factors, it is the latter which have caused the current global environmental crisis. Modern society's heavy dependency on fossil fuels (coal and oil) has been blamed for causing and perpetuating the problem.

In Zimbabwe high air pollution levels are a cause for concern as they pose serious humanhealth and environmental risks. The country has the potential to develop cleaner sources of energy such as: solar, wind and more hydro-electricity power plants. During the last three decades, some efforts have been channeled towards these projects, reflecting some political will at the national level. However, poverty at the grass roots level has prevented most rural folks from adopting the new technologies of solar and wind energy whichare environmentally-friendly. Obviously, there is a need for more resources at national level if sustainable development (SD) has to be achieved in future. This paper has discussed the main causes, sources and impacts of air pollution before suggesting possible solutions. It is based on information that was obtained from a questionnaire surveywhich was administered in 2014. The paper shows that air pollution is a growing environmental challenge in Zimbabwe and should be addressed seriously at both local and national levels.

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