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Fixing pollution: Women's role in the developing countries

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ABSTRACT

Pollution is a challenge globally. This is part of what the 17 Sustainable Development Goals set by the UN are meant to tackle. Good Health and Well-being, Clean Water and Sanitation, Affordable and Clean Energy, Sustainable Cities and Communities, Climate Action, Life Below Water, and Life on Land (Goals 3, 6, 7, 11, 13, 14, and 15 respectively) are greatly affected by environmental pollution. To achieve these targets, men, women, and children are needed as stakeholders. For the purpose of this paper, the roles women should play in developing countries are discussed. Although women have actively involved in pollution reduction or elimination in developing countries, their roles have been limited due to several factors. In this paper the questions: What is the specificity of women in environmental pollution? In what sense does it bring solutions to environmental pollution? To achieve this, the objectives of the present review are to systematize and explore in-depth the causes of pollution in developing countries and the roles to be played by women in solving or reducing the environmental problems.

1. INTRODUCTION

Pollution is a challenge for the developing countries. The World Bank Group (2018) gave the report that about 9 (16%) million premature deaths in 2015 of all deaths worldwide were caused by air, land, and water pollution. Of this, about 92% of all pollution-related mortality is in developing countries. The air pollution alone costs the global economy US\$5.7 trillion—4.4 percent of global GDP (The World Bank Group, 2018). To partake in this menace, The World Bank has been providing the technical assistance needed for countries affected by pollution problem by providing technical assistance through raising awareness about the detrimental impact on global health, facilitating knowledge generation and sharing, and pollution management. The Pollution Management and Environmental Health (PMEH) program of the World Bank intends to end poverty, improve global health, and boosting shared prosperity by reducing pollution.

There is no gainsaying that environmental problem such as ozone depletion, destruction of biological resources and of forests, the impact of desertification, dumping of hazardous wastes, and climate change have given the awareness that the environment is in danger. Peoples and governments throughout the world over have taken bold steps to reduce or eliminate this problem (Wuyep et al., 2014). For these efforts to be effective, it is paramount to involve women who are part of the contributors to the environmental pollutions to contribute their roles in this herculean task.

Past years in developing countries, especially in Africa, women were relegated to the background. They play the second fiddle to men. It was believed that their roles were in the kitchen. Recently, there was increased attention to the roles they play as homebuilders, economic providers and their role in reproduction in the communities and different countries of the world (Chelala, 2011). Their roles have surpassed these, they are now needed in the solving or reduction of environmental problems. Women's involvement in the formulation, planning, and execution of environmental policies is slow, despite the increase in national and international recognition that without their full participation, there may not be a possibility of progressing consistently and constantly in environmental sustainability.

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Women are more prone to sickness, disease or death from agro-chemicals poisoning than their male counterparts because of their involvements in agriculture. The direct contact of women to environmental hazards makes them more susceptible to abortion and foetal damage (Adesoji, 2001). As the overseer of the homes, they are more prone to health problems due to poor sanitation, air and water-related diseases which may be transferred to children and husbands (Egaga and Aderibigbe, 2015).

According to The Global Development Research Center (GDRC) (2018), policymakers and governments began to create the awareness as far back as the '80 of the relationship between the environment and gender issues and pronounced changes began to happen with regards to natural resource and environmental issues. Women play an essential role in the management of natural resources, including soil, water, forests and energy... and often have a profound traditional and contemporary knowledge of the natural world around them (Tesfamichael, 2015). In the developing countries, women are victims of the environmental pollution, they form 50% of the population. This made them be an important human resource to combat environmental pollution (Devi, 1994).

The Millennium Development Goals (MDGs), with its measurable targets, ended in 2015. It was observed that much was not achieved, especially in the poor countries (MGDFund, 2018). On this note, the 17 Sustainable Development Goals (SDGs) was built on the eight MDGs, which are supposed to eradicate extreme poverty and hunger; achieve universal primary education; promote gender equality and empower women; reduce child mortality; improve maternal health; combat HIV/AIDS, malaria and other diseases; ensure environmental sustainability; and to develop a global partnership for development (United Nations, 2018). To achieve the Sustainable Development Agenda by 2030 women should be mobilized.

What is the specificity of women in environmental pollution? In what sense does it bring solutions to environmental pollution? The main objective of the present review is to systematize and explore in-depth the causes of pollution in developing countries and the roles to be played by women in solving or reducing the environmental problems.

1.1. What is pollution?

This term is the contamination (unconcerned and uncontrolled) of limited environmental resources present for the safe survival of animals and humans. Its detrimental effects on lives and the planet may not be completely reversible. In a nutshell, it can be termed as contamination of the natural environment with pollutants hazardous to human and animal health (Abulude et al., 2017a). There should be an urgent attention to curtail and minimize it for a better healthy living and to prevent endangering lives within the environment. In all countries of the world, pollution is on the increase due to rise in human activities from their involvement in technology and increased population. The contributions of non-anthropogenic and anthropogenic activities are the factors to never-ending pollution of all sorts.

2. TYPES OF POLLUTION

Globally, pollution is a significant problem facing the environment. Day by day out, the more the world's population the more the increase in potentially toxic substances that are released into the ecosystem (Lake, 2017). Different types of pollutants come from a number of sources. The knowledge of the different types of pollution and sources can assist in the understanding of the potential effect of these pollutants on the health of man and animals, and that of the planet (Lake, 2017).

The sources of pollution are numerous. Examples are enumerated in this review.

2.1. Air pollution

One of the major contributors of pollution to the environment is air pollution. The phenomenon is the contamination of natural air with dangerous gases. Automobiles, industries, and natural disasters like volcanoes are culprits which release gases like carbon monoxide (CO), carbon dioxide (CO₂), sulfur dioxide (SO₂), methane (CH₄) and other harmful into the air (Abulude et al., 2018). Dust is a particulate present in the air. This is harmful, especially to the respiratory system (Berg, 2017). Materials near industries are at the receiving end of dust particles. The sources of air pollution are from the burning of fossil fuels, vehicles (Fig 1), and factory emissions. The burning of fossil fuels contributes to the formation of smog, a dense layer of particulate matter that hangs like a cloud over many major cities and industrial zones. Air pollution contributes to respiratory problems (asthma, lung cancer, chronic bronchitis, and other lung ailments). NO₂ and SO₂ in the air, when coming in contact with water or precipitations, form acid rain, a lower (more acidic) pH than normal. Acid rain harms forests, species that live in water bodies, and degrades outdoor statues, monuments, and buildings (Berg, 2017; Abulude et al., 2018).



Fig 1. A vehicle emitting pollution, Source: Study Read (2018)

2.2. Water Pollution

This is a scenario formed when the discharge of a large quantity of human, industrial wastes enters the rivers, ponds and sea water thereby making them contaminated. Thereafter, making the water harmful to drink and also endangering lives on the water (sea and marine) animals (Fig 2).



Fig 2. A polluted water, Source: One Water (2015)

A major source of water pollution is runoff from agricultural fields, industrial sites, or urban areas. Runoff disrupts the body's natural water balance. Fertilizer can cause algal blooms (an explosive growth of algae), choking out other plants and decreasing the amount of available oxygen necessary for the survival of other species (Berg, 2017). Raw sewage is another type of water pollutant. When sewage gets into the drinking water supply, serious stomach and digestive issues may result, including the spread of diseases such as typhoid or dysentery. A third source of water pollution is a trash. Improperly disposed of items, such as plastic bags, fishing line, and other materials may accumulate in the water and lead to the premature death of animals that get tangled within the garbage (Berg, 2017).

2.3. Land pollution

Excess dumping of toxic waste, chemical, or other wastes causes land pollution (Fig 3). Polluting the land by harmful chemicals (fertilizer, pesticide, insecticide, fungicide and so on) can lead to the entry of pollutants into the food chain. Also, carefree attitude of disposing of industrial wastes, defecating in the open spaces cause pollution, which eventually leads to health problems like malnutrition as pollutants pass through plants to humans and animals. Other sources of soil pollution include asbestos, lead, and PCBs (Berg, 2017).



Fig 3: A land polluted with waste dump, Source: Study Read (2018)

2.4. Sound pollution

Sound pollution (Noise) is a disturbance of the cool or silent environment with too much noise. Sources include vehicular sounds, the loud speakers used for fun or public speeches, temples, mosques, churches, advertisement, sirens, and so on (Fig 4). This pollution has a severe impact on sick, the old people, small children (Berg, 2017). Noise pollution typically refers to human-made noises that are either very loud or disruptive in manner. This type of pollution has been shown to impact the movement of sea mammals, such as dolphins and whales and also impacts the nesting success of birds.



Fig 4: Sound Pollution caused by loudspeakers, pedestrians, and buses, Source: Chatterjee, (2017)

2.5 Dust pollution

This is a pollution wherein the contamination is due to dust particles in the air. Vehicular movements release dust in the environment, also the industrial, farming, mining, and pollination activities end up in the release of dust into the air (Fig 5). The dusty airs are transported several kilometers from the sources to other parts of the location. Meteorological parameters have significant effects on the dust pollution. Contamination of the by dust translates into health problems (breathing difficulty leading to infections, congestion of breath).



Fig 5: Dust pollution caused by plowing of the farm, Source: Kiama Municipal Council (2017)

2.6 Radiation pollution

This is a scenario due to abnormal radiation in the environment caused by the use of radioactive elements from the surrounding areas, especially near atomic energy stations. Batteries, wireless internet, and mobile towers are the culprit for the release of radiation into the environment (Fig 6). Excess radiation in the air has a serious health effect on lives, even the pollution has caused the extinction of birds, bees and other insects from their natural habitat.



Fig 6: A phone releasing radiation into the environment

2.7 Thermal pollution

When there is excess heat released into the environ, the temperature of the surroundings increases drastically, which eventually leads to thermal burn, draught, and reduction of oxygen in rivers, streams, and oceans this makes the water and marine animals to struggle for their survival. Thermal power plants and industries involved in metal molding are the cause of thermal pollution (Study Read, 2018). According to HelpSaveNature (2018), deposition of warm water from industries into natural water bodies causes thermal pollution (Fig 7). This not only disturbs the aquatic life but also reduces the quality of water.



Fig 7: Deposition of warm water from industries into natural water bodies causing thermal pollution, Source: HelpSaveNature (2018)

2.8 Light pollution

This pollution is the large quantity of light produced in most peri-urban, urban, and other heavily-populated areas (Fig 8). It prevents people from observing the features of the night sky and has effects on the activities (reduction of migration patterns) birds and those of nocturnal animals (Berg, 2017) At night, light pollution affects the drivers by causing distractions for them. It is believed that light pollution is one of the causes of obesity, insomnia and other health issues.



Fig 8: Urban area with large quantity of light, Source: Mirana (2012).

2.9 Plastic pollution

This is the compilation of plastic products in the environment, land, waterways, and oceans, which adversely endangers wildlife, wildlife habitat, or humans. This pollutant is categorized into micro-, meso-, or macro debris, based on size

(Hammer et al., 2012). The inability of plastic and polyethylene to decompose for many years add up to pollution. Plastic pollution is one of the contributors to air, water, and soil pollution (Fig 9). Humans are also affected by plastic pollution, such as through disruption of various hormonal mechanisms. Even animals which graze this plastic die due to problems in the intestine.



Fig 9: *Plastic polluted environment*

3. POLLUTANTS

A pollutant is a material or energy which enters the environment in the long run adversely affects the usefulness of a resource causing long- or short-term damage to plant or animal species, interfering with human amenities, comfort, health (cancer, birth defects, other serious health problems), property values, adverse environmental and ecological effects. Pollutants are the substances which pollute or contaminate the environment (Kapoor, 2011). Pollutants are divided into gaseous (H₂S, CO₂, NO_x, CO, SO_x, CFCs), liquid (chemicals, oil and petroleum, human and animal wastes) and solid (metals, plastics etc) - (biodegradable and non-biodegradable) (Gsenviro (2015).

3.1. The six criteria pollutants

Criteria pollutants are the only six air pollutants (PM, O₃, CO₂, NO_x, CO, SO_x) with the National Ambient Air Quality Standards (NAAQS) that depict standard limits of these substances in ambient air (Idaho.gov, 2018). They are identified by The Clean Air Act (CAA) of 1970. The criteria pollutants are problematic in the sense that they have health (lung disease, respiratory damage, or premature death) and environmental (acid rain, radiation, and ozone depletion) effects and property damage (Idaho.gov, 2018). It is expected that the six pollutants should be reviewed periodically and the standards should not be exceeded more than once in a calendar year.

3.1.1. Particulate matter (PM)

The PM is an inhalable and respirable particle which is composed of sulphate, nitrates, ammonia, sodium chloride, black carbon, mineral dust, and water. There are large particles that can be seen as soot or smoke, while others can only be detected with the use of a microscope. Particles classified by their 'aerodynamic diameter' (PM₁₀, PM_{2.5}, and PM_{0.1}) pose the greatest risks to health, as they are capable of penetrating peoples' lungs and entering their bloodstream (Abulude et al., 2017b). They are also classified according to their chemical composition. The toxicity of PM depends on their size and chemical composition. PM sources from human activities like combustion engines (both diesel and petrol), solid-fuel (coal, lignite, heavy oil and biomass) combustion for energy production in households and industry, as well as other industrial activities (building, mining, manufacture of cement, ceramic and bricks, and smelting). Some particles are emitted naturally. The sources are bushfires, dust storms, pollens and sea spray.

Australian Government (2005), researchers have linked exposure of particle pollution to a number of health problems, including respiratory illnesses (such as asthma and bronchitis), cancer and cardiovascular disease, which are pronounced in vulnerable groups, like the very young and the elderly. PM is the major cause of reduced visibility. This can be a serious safety issue on roads and in traffic tunnels and can also affect our enjoyment of the natural landscape.

3.1.2. Black Carbon (BC)

One climate pollutant is Black carbon. It is a major component of PM_{2.5}. BC is one of the largest contributors to global warming. It is also known to decrease agricultural yields and accelerate glacier melting. BC soot is a pollution arising from the burning of wood and other plant material, and industrial exhausts. The burning leads to the spread of fine carbon soot into the air (Study Read, 2018), causing irritation to the respiratory system to those who inhale the contaminated air and also darkening the skies thereby reducing vision on the roads (Study Read, 2018).

3.1.3. Nitrogen dioxide (NO₂)

Nitrogen dioxide is a gas that smells nasty. Nitrogen dioxide, mainly emitted by power generation, industrial and traffic sources, is an important constituent of particulate matter and ozone (WHO, 2018). It is the symptoms of bronchitis and asthma, lead to respiratory infections and lung function reduction, growth. Also, it may be responsible for a large disease burden, with exposure linked to premature mortality and morbidity from cardiovascular and respiratory diseases (WHO, 2018). NO₂ is an important air pollutant simply because it adds to the formation of photochemical smog, which can have significant impacts on human health, causing wheezing, coughing, colds, flu and bronchitis (Australian Government, 2005).

3.1.4. Ozone (O₃)

One of the major components of photochemical smog is O₃. It is not directly emitted like BC it has a health problem which includes breathing, asthma, reduced lung function and respiratory diseases (WHO, 2018). Chest pains can also occur in some people (Australian Government, 2005). O₃ is formed when CO, CH₄, or VOCs are oxidized in the presence of NO_x and sunlight. In addition to their role as ozone precursors, CO, VOCs, and NO_x are dangerous air pollutants themselves. Sources of NO_x, CH₄, and VOCs are from motor vehicle exhaust, industrial facilities, chemical solvents, waste, the fossil fuel and agricultural activities. Apart from O₃ health impacts, tropospheric ozone is a short-lived climate pollutant and one of the most important greenhouse gases (WHO, 2018).

3.1.5. Sulphur dioxide (SO₂)

Sulphur dioxide is a gas, which is primarily produced by the burning of fossil fuels (coal and oil) and the smelting of mineral ores that contain sulphur. Exposure to SO₂ affects the respiratory system and the function of the lungs and causes irritation of the eyes. Inflammation of the respiratory tract from SO₂ can aggravate asthma and chronic bronchitis, as well as increases the risk of infection, leading to increased hospital admissions and visits to emergency rooms. SO₂ also combines with water in the air to form a sulphuric acid - the main component of acid rain (WHO, 2018).

The main source of SO₂ in the air is the generation of electricity from coal, oil or gas that contains sulfur, the processing of mineral ores in which sulfur dioxide is released and burning fossil fuels. Sulphur dioxide is also present in motor vehicle emissions (Australian Government, 2005). Those most at risk of developing problems if they are exposed to sulphur dioxide are people with asthma or similar conditions (Australian Government, 2005).

3.1.6. Carbon monoxide (CO)

Carbon monoxide is a colorless and odorless gas, which at high levels can be harmful to humans by impairing the amount of oxygen transported in the bloodstream to critical organs. Although high concentrations of CO are more of a concern indoors, emissions outdoors, particularly in developing countries can be high. New evidence also reveals that long-term exposure to low concentrations is also associated with a wide range of health effects. The main sources of ambient CO include motor vehicle exhaust and machinery that burn fossil fuels (WHO, 2018).

The natural concentration of carbon monoxide in the air is around 0.2 parts per million (ppm), the amount is not harmful to humans. Natural sources of carbon monoxide include volcanoes and bush fires, industrial activities, tobacco smoke.

4. ROLES OF WOMEN GLOBALLY

No doubt globally, women play important roles in homes and outside. They play motherhood roles and because they are close to nature, they are involved in the socio-cultural activities to sustain life (Agüera-Cabo, 2010). They take care of the house and surroundings (Devi, 1994). Worldwide, there is an increase in the awareness of the necessity of using women to contribute to the reduction of environmental problems, as well as working on the activities towards the sustainability and development of their communities. The results of a world survey conducted and by the United Nations Environment Program on public attitudes on the environment revealed that women are more prone to a lower standard of living than men this means that they are more prone to health risks (Chelala, 2011). The adopted 2030 Agenda (MDGs/SDGs) of the General Assembly showed that much is expected in eradicating or reducing atmospheric problem worldwide. Also, the Rio

declaration on general rights and obligations says 'that women have a vital role in environmental management and development' (Rio, 1992). This shows that women have a significant role to play in environmental protection.

Few successes have been noticed by women in reducing environmental problems world over (Wuyep et al., 2014). According to (Wuyep et al., 2014), women in Jos, Nigeria engage in the drainage and waste disposal. In India, women have been involved in the creation of awareness on environmental pollution, they have also involved in the national policy on how to eradicate pollution. A scenario is a legal case (Krishna Gopal Vs. State of Madhya Pradesh) where one Mrs. Sarla Tripathi took a factory to court on the ground that the factory was polluting their community with smoke, ash, ground vibration, and noise (Krishna Gopal, 1986). Also in India, women have been the major conservers of agro/bio-diversity (Adiyat, 2016). In Myanmar, women are known to be rehabilitators, managers and innovators of the natural environment (Aye, 2018). In Ethiopia, it was claimed that women understand the art of sustainable consumption patterns more than men, this has made them use more of environment-friendly and organic food and eco-labeled products (OECD, 2008; Bayeh, 2016). Women in Eritrea are useful in the area of reducing land degradation, and desertification as well as soil conservation and water harvesting, they are the principal drivers and actors of communal work, especially in the area of building modified stove which assists in the provision of cleaner air (Tesfamichael, 2015). Lawyers in Kenya (The Federation of Women Lawyers in Kenya (FIDA) are now providing free legal support to women on to assist them to fight for their land rights, especially in the area of land degradation (Irish Aid Key Sheet, 2018). Also in Ethiopia, women have been empowered by issuing them land certificates which gives them the rights to own their lands by this, they will try as much as possible not to lose these lands to environmental pollution (Irish Aid Key Sheet, 2018b).

Women and their little one's children are most prone to environmental disasters, vulnerable to reproductive and sexual health problems, and whenever they lose their breadwinners (husbands) they are made to take care of their families and even compel to struggle for recognition in patriarchal systems (DCI (2005). On many occasions, women are the principal drivers and actors of communal work. They are directly affected by the impact of environmental pollution. For these reasons, the roles of women to reduce or fix pollution should include the followings:

4.1. Roles of Women in Developing Countries

4.1.1. Illegal mining

No doubt women have played active roles in mining in developing countries. In Africa, it was documented by Hinton et al. (2003) that women have direct involvement in mining activities ranging from 40-50%. Gueye, (2001) noted that over 90% of women in Burkina Faso are involved in mineral processing women, while Mali, Tanzania, and Sudan had 50%, 70%, and 35% respectively. The majority of the women are involved in ancillary roles like cooks, service provider, and sales of liquor. Nowadays, there are many illegal mining locations throughout the developing countries. On this premise, there is an increase in pollution of the environment. To reduce the effect, women should not be left out. Since there is an illegal mining site, definitely, there will be little or no report on the toxic mining waste, then the public will always be in the dark. Women should utilize the power and efforts to fight for greener mining and enforcement of regulations. Illegal miners should be educated about the approach to mining activities within the country. They should be informed of the potential hazards in the shady deals.

4.1.2. Reduce noise levels

Noise pollution throughout the world is bad and unhealthy for the body. Developing countries are the major culprits of this. Most inhabitants put up, carefree attitudes in handling the noise levels. Evidence have shown strong correlations between environmental noise and elevated risks of high blood pressure, headache, children's growth and learning development, the risk of depression, anxiety and insomnia (Huss et al., 2010; Stansfield, 2016). Women with their roles in the community should contribute their quota to cutting back noise pollution. They should try to enlighten their household, colleagues, and others the difficulties regarding noisy situations. In homes and workplaces, soundproof the rooms with a less expensive option of covering the walls with carpets and other covers (mineral wool, blankets, acoustic foam panels, bookcases filled with books) which soften and absorb sound (Houzz, 2013). In the event of noise in the surrounding, women and others should wear ear protection devices. When noisy items like blenders are used they should be padded. All electronic gadgets should be turned off when not in use even television and radio should be operated in low volumes, and noise from workplaces should be reduced. All mechanical engines should have good silencers. All damaged ones should be fixed immediately. In a situation where vehicles are modified to be louder, the owners should be informed of the problem, if they refuse to reduce their noise, they should be reported to the law enforcement agents. Women are advised to move to a quiet spot that is as free of sound as possible before one is back the emotional balance would have been restored. The use of earplugs and noise-canceling headphones will assist where necessary. Finally, in communities, neighbors can agree to limit the noise levels or use speakers, lawn mowers, horns and other noisy motors during certain hours, for the benefit of the whole neighborhood.

4.1.3. Avoid the use biomass burning

Women do most of the cooking in developing countries. They use or rely on solid biomass fuels for their cooking. According to Bond et al., (2007), the method used contributes to 50% anthropogenic and 25% global emissions of BC. Also, about 1.6 million deaths have been estimated by WHO due to inhalation of smoke due to biomass fuel (WHO, 2002).

4.1.4. Reduction of plastics and cellophane bags

Plastics and cellophane bags are commonly used in developing countries. These find their way into homes and offices unknowingly through the wrapped items purchased from the local markets or supermarkets. To reduce the influx of these into homes, efforts should be geared towards using a reusable version like paper, bottles, and the rest. Women should opt for natural exfoliants (oatmeal or salt), instead of buying items enclosed in plastics. All plastic containers should not be disposed off, they should be gathered and submitted to the waste disposal board for onward recycling. Or in the alternative, the containers could be sent to the manufacturers of the products for recycling or reuse. Another option for women to reduce their plastic containers is to buy in bulk (Engler, 2016). Buying in one big container is better than multiple containers over time. Efforts should be made in preparing and storing foods and beverages using non-plastic utensils, pans, containers, and covers (including wrap materials) whenever possible (Nnaji, 2018). Goods and foods should be purchased with minimum package instead of cellophane bags and plastics they can be stored in glass, papers and other stainless steel materials. In many developing countries laws on plastic pollution have been enacted in this case, what women need to do is to support the enforcement and the workability of the laws. Part of support, women can give is to mount pressure on manufacturers by joining in the campaign. This can be done by making the voices heard in terms of packaging using the social media (Engler, 2016).

4.1.5. Choose environmentally friendly cleaners.

In an African set-up, most of our roads are unpaved and surroundings are not cemented for this reasons sand, dust and dirt abound everywhere. To get them cleaned, most of the women use brooms to do the sweeping or pushing dirt into a pile and cleaning. In the course of doing this, dust is blown or released which can be transported afar by the wind within the vicinity. The health problem arising from the inhalation of the dust could be severe. For a woman to make the environment clean, she should wet the ground or surface of the area with water, which makes the dust entrapped on the floor or using a vacuum cleaner. Again, when making a purchase of any product, before paying, the environmental health scoring rate (Green is good. Red is bad) should be checked. Red color depicts the potential environmental problem or danger. In addition, energy should be conserved by electrical gadgets when not in use and equally participate in utility energy conservation programs. Regular routine maintenance of automobiles such as changing the oil and filters, and checking tire pressure and wheel alignment will assist in making the environment-friendly.

4.1.6. A Good farm practice

It is of note that women in the developing countries have more contact with the environment because they are heavily involved in their agricultural activities. Women are main actors when managing their natural surroundings and use different methods to deal with the kinds of environmental situations they might face. According to the World Bank (1991), women play an essential role in the management of natural resources, including soil, water, forest, and energy. In order to discharge their duties well in good farm practices, women should be well trained in the handling and the use of chemicals, the use of traditional pesticides, insecticides, and fertilizers can also be used as supplements. The disposals of the containers should be with care and they must duly follow manufacturers' specifications and safety gadgets should be properly used before and after their exercises. If women in the cause of their work on the farms and they notice usual happenings as per environmental problems, they should immediately notify environmental experts, government officials, and the traditional rulers who should immediately take appropriate steps. In order to avoid agricultural pollution, women should try as much as possible to use Integrated Pest Management. Organic fertilizers and wastes (agricultural and household) instead of manufactured ones which combine with air to form solid particles in the air (AGU 100, 2016). Women farmers should imbibe conservation practices by planting cover crops to help stop soil erosion, zero-tillage, use crop and pasture rotation methods, improve wildlife habitats and maintain agricultural productivity, ensure water cleanliness for livestock and others. Also, women should always use, preservation methods which will assist them to keep things the way they are, to keep them for future generations and also improve their quality (AnimaSmart.Org, 2018). Finally, women, farmers should use farm resources in moderations and even encourage their wards, husbands, and colleagues to do same.

4.1.7. Pipeline damage – explosion

When **pipeline explosions** happen, gas will be released which results in flames. The crude oil will be released too into the surrounding waters. The outcome of these incidents may be serious injuries, the **destruction of private property**,

environmental damage and many more. The world over, there were reported cases of pipeline damages resulting in many explosions and even death of animals and human (Bonner and Suhartono, 2006; Reuters, 2012; *National Transportation Safety Board, 2014; Niyi, 2016; Daniel, 2016; The Indian Express, 2017*). The causes of these could be as a result of natural and man-made damages - *natural disasters such as earthquakes, floods or fires, harsh environmental factors, excavations, vandalism, even terrorist attacks* (Lorusso, 2011). To prevent pipeline damages, efforts are in place to: put up safety issues like overhauling of pipes, pipeline safety programs, fine and jail pipeline vandals, constant monitoring of the pipeline areas – security and other professionals, fast response of the emergency crew to the scene of the problem, prevent excavation and digging, no farming or illegal activities near the pipelines (Osher, 2017). Additionally, the use of bulletproof and fireproof in the areas, barrier layers created, the conduct of emergency tests, the use of communication redundancy, and even battle ready for the potential threats (Lorusso, 2011). To prevent the environments from pollution through pipeline damage, women have many roles which include: immediate alert of security and monitoring team of vandalization of the pipelines, non-participation in the shady deals, women should discourage their family members in the involvement, they should be familiar with proper use of fire extinguishers, obey orders of government agents, avoiding the use of farm implements that can produce sparks in the vicinity,

4.1.8. Avoid wastes and refuse to burn

The burning of refuse or waste is illegal not only because it is a nuisance to people around, but may release harmful chemicals which are hazardous to man and animals' health and the environment (EPA, 2009). Burning wastes in fires form toxic and dangerous by-products which may not be destroyed by the fire, but become airborne on soot particles (Citizens Information Board, 2016). The aftermath effect may be inhaled or washed out of the air and deposited into the soil and crops, where they can readily enter the food chain (Citizens Information Board, 2016). As women are the custodian of the home, they are to maintain a clean environment. Arrangements must be made for the collection and disposal of the household wastes or refuse by the waste collectors or operators who do this frequently (weekly). Women must provide waste bins (wheelie bins) or bin bags for easy collection and transportation. Composting of kitchen waste (biodegradable waste) is another method by which women can use to reduce the wastes generated in homes. Instead of burning the refuse, a hollow container (compost container) or small area of land can be dug and used for composting. Other minor tools like a garden shovel or fork will be needed for turning and removing the compost. Composts are used as organic fertilizer. Although women may not be able to recycle their refuse or waste, they would be involved in the gathering, sorting and sending them to the factories for recycling. If women are able to do this, it means they have saved the environment and living things around from being endangered. Women should learn and be educated on recycling, minimizing, preventing, and re-use of wastes instead of endangering the environs through burning. Women can convert waste to wealth. In Kenya, it was reported that women turned wastes (plastics) into useful products (bags, hats, carpets, and others). These efforts have assisted in preventing short-lived climate pollutant emissions from the open burning of plastic (CCAC, 2018).

4.1.9. Women environmentalists

In spite of the progress so far on the reduction of environmental pollution globally, women environmentalists have in developing countries have not made much impact. To make women more proactive, the Network of Women Ministers of the Environment (NWME) has made frantic efforts in making practical recommendations to solve environmental problems confronting countries; collaborations between NGOs, intergovernmental agencies, and civil societies and forming leadership to influence international and national policies (UNEP, 2004). In 2011, the Nobel Peace Prize was awarded to three women whose roles were fighting for human rights, apart from this, another was given to Wangari Maathai, her efforts and others restored Kenya's lost forest by planting over 30 million trees and also empowered women in environmental preservation methods (Chelala, 2011). In Nepal, Saraswoti Bhetwal has assisted indigenous women in the use of composts, drip irrigation, roof water harvesting, other strategies in reducing their environmental problems. Olga Speranskaya of Russia and her team in their community identified and eliminated the Soviet legacy of toxic chemicals in the environment with NGOs. In Honduras, the Emergency Committee Garifuna formed by women provided seed banks for food security, reduced erosion of coastal areas by planting fruit trees, reforestation, and assisted communities in relocating to low-risk areas communities from high-risk areas. While elsewhere in Bolivia, the Centro de Mujeres Candelaria and the team, led women ins grassroots groups to predict hazardous events in their ancestral practices and protect their farms and food (Chelala, 2011). Although women from different countries have shown tremendous concern and participation in reducing pollution, more is still expected of them because they are susceptible to several environmental threats. They should be empowered to get involved in the development of and participation in environmental pollution programs and policies.

4.1.10. Planting of trees

Trees are noted to have 22 benefits which include conservation of energy, prevent pollution (air, soil, food, water), medical, and financial benefits (TreePeople, 2018). In considering the type of flora to plant, they must have the **ability to absorb CO₂** in a life cycle of 30 years, filter air pollutants, its ability to transform into biomass and **to attach chemicals such as benzene, nitrogen oxide, dioxin** and many others (Bressa, 2016). Again, trees that have the ability of to produce

volatile organic compounds (VOC), which can increase the concentration of ozone in the environment of small populated areas, should not be many (Bressa, 2016). In big cities, the following trees can be considered for planting: Elm (*Ulmus minor*), Common ash (*Fraxinus excelsior*), Wild linden (*Tilia cordata*), Norway maple (*Acer platanoides*), Turkey oak (*Quercus cerris*), Ginkgo (*Ginkgo biloba*), and Broad-leaved linden (*Tilia platyphyllos*). Shrubs, an herb garden, houseplants, vegetable crops, decorative flowers, can be considered for planting because they also reduce the amount of CO₂ in the air, increase oxygen, and eliminate toxins (Stone, 2010). In Kenya, over 30 million trees were planted by women's group (Chelala, 2011). Also in Lagos, Nigeria former state governor's wife (Mrs. Fashola) encouraged women in tree planting by leading them in a tree planting campaign and environmental sanitation. Formation of women tree growers' association in Ghana rural communities, assisted imbibing and nurturing tree planting culture (Tola-Iwajobi, 2013). To involve women in the control of pollution using trees and plants, they should be made to understand the issues and concerns of tree planting by sensitizing them on the need. Again, they should be involved in tree planting decision making and mobilize them to belong to different tree planting groups. Furthermore, women should be discouraged from the cutting of trees for their sustainability. Lastly, women should be involved in tree planting campaigns in order to create awareness.

5. CONCLUSION

This paper discussed the roles women can play in fixing pollution, particularly in the developing countries. It looked at types of pollution (air, water, noise, thermal, and others), and the pollutants (PM, NO_x, SO_x, CO, and others). Women identified as home builders and good managers have a stake in fixing pollution as they are involved in their day to day activities. They are directly affected by the impact of environmental pollution. For these reasons, the roles of women in reducing or fixing pollution should include planting of trees, avoiding dumping and burning of refuse, good farm practice, the use of environmentally friendly cleaners, and others relevant roles. Finally, women environmentalist or movements should do more in the forcing the relevant government and environmental bodies to do the needful in the fixing of pollution.

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