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Challenges of monitoring and developing environmental policy in Sub-Saharan Africa: the case of air pollution and biofuels in Ghana

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INTRODUCTION

There has been an increasing concern about the state of air quality in many cities of the developing world, especially within an African context. This situation has arisen because of rapid population growth and its attendant increase in vehicle ownership, increased use of solid fuels for cooking and heating, and poor waste management practices (see Figure 1). Industrial expansion is also a major contributor to the deteriorating level of air quality in these cities (Arku et al 2008; Amegah & Agyei-Mensah 2017). Consideration should then be made to the environmental issues associated with the growing demand for natural resources, such as mineral and biofuels. The exploration of these resources demands strong and supportive environmental policy, with a "firm legal, regulatory and institutional framework" to ensure that national development does not hamper the environment and ultimately negatively affect the populations of African countries (Mabogunje 1988; Mpakati-Gama et al 2011). Effective monitoring and evaluation mechanisms need to be put in place to reduce emissions from increased vehicle ownership as well as clean energy use.

In this paper, we focus on two areas of environmental monitoring in Ghana -- air pollution and the development of biofuels. We focus on air pollution and biofuels because these are current issues of national and international interest. In parts of Ghana, air pollution is already reported at alarming concentrations (Arku et al 2008) and United Nations reports from as far back as 2007 have forecasted for astronomical increases in the use of biofuels across Sub-Sahara Africa (SSA). The demand for biofuels in SSA is expected to grow by 170% between 2006 and 2010, with biofuel accounting for 25% of the world energy needs in the next 15-20 years (UN-Energy 2007). Below, we elucidate the challenges for developing, monitoring and evaluating air pollution and biofuels policy in Ghana.

Some Sources of Air Pollution in African Cities

One of the major components of air pollution that affects human health is particulate matter. Anthropogenic particles are typically formed from incomplete combustion and mechanical wear. Particles with an aerodynamic diameter of up to 10 micrometers (PM_{10}) may enter the respiratory system, with particles smaller than 2.5 micrometers being capable of lodging deep in the lungs and even entering the bloodstream ($PM_{2.5}$) (Agudelo-Castaneda et al 2017). The World Health Organization's air quality guidelines recommend that the annual mean concentrations of $PM_{2.5}$ should not exceed 10 µm/m^3 and 20 µm/m^3 for PM_{10}**.** Most low and middle-income countries in SSA do not have any measurement for PM_{10} and $PM_{2.5}$ – this is irrespective of the direct links to estimates of health risks from exposure to these air pollutants (World Health Organization 2016). The lack of measurements for ambient air pollutants is largely responsible for the absence of air quality indexes in most developing countries, especially in SSA. The 2016 WHO Urban Ambient Air Pollution database estimated the average PM_{10} and $PM_{2.5}$ concentrations for Africa to be 119 µg/m^3, also earlier studies by Brauer et al. (2012) estimated $PM_{2.5}$ concentration in SSA at 100 µg/m^3. These levels are about 80% higher than the WHO standard of 20 µg/m^3, which is the safe exposure limit with little or no adverse health effect.

Dionisio et al (2010b) in their study in Accra, Ghana found particulate matter with 10 microns (PM_{10}) levels to range between 39 µg/m^3 for high socio-economic status area and 96 µg/m^3 for low socio-economic status location in the city. PM_{10} levels were even recorded as high as 400 µg/m^3 at some monitoring locations (Arku et al 2008; Dionisio et

al 2010a; Rooney et al 2012) . While there is evidence to suggest that breaches of the WHO air quality standards are widespread, unfortunately there is often lack of effective monitoring and evaluation mechanisms to ensure compliance (Mpakati-Gama et al 2011).

CHALLENGES OF IMPLEMENTING POLICIES

The first challenge for developing and monitoring air pollution and biofuels policy in Ghana is the lack of research and appropriate data. For instance, in countries such as China and India where air pollution are major problems, policy makers and scientists actively engage in and sustain research initiatives to find solutions to the problem. In contrast, South Africa is the only country in sub-Saharan Africa with an air-quality monitoring program (Wetsman 2018).

Over the years there has been various attempts to institute an air quality monitoring program in Ghana. This however has not been a consistent program because such initiatives are largely funded by donor agencies and institutions, making them unsustainable over a long period. A case in point is a major study on air pollution undertaken by a team of researchers from Harvard University, Imperial College of London and the University of Ghana between 2007 and 2013, led by Prof. Majid Ezzati, and funded by the National Science Foundation. The results of this study show that PM in the four selected neighborhoods of Accra is substantially higher than stipulated in the WHO Air Quality Guidelines and in some cases even higher than the WHO Interim Target 1, with the highest pollution being recorded in the poorest neighborhood. The study has resulted in a number of publications and informed policy directions on air pollution reduction in Accra (Arku et al 2008; Dionisio et al 2010a; Dionisio et al 2010b; Zhou et al 2011; Rooney et al 2012).

There is currently an air quality monitoring network run by the Ghana Environmental Protection Agency (GEPA) which covers mainly the Greater Accra Region, with periodic monitoring in three other regions also run throughout the year as a control measure. The monitoring network is made up of fourteen (14) monitoring stations in total, ten (10) of these stations are by the roadside to measure traffic generated air pollution and four (4) of the monitoring stations are at various industrial zones in the Greater Accra Region. This monitoring program is funded by the US EPA and World Bank for the period of 2014 to 2019 measuring PM_{10} and Total Suspended Particles (TSP).

In the specific case of biofuels, Jumbe et al (2009) refer to the Ghana poverty reduction strategy paper, highlighting the importance of energy for poverty reduction and the need to increase access to affordable energy sources for domestic and industrial use, in order to stimulate economic growth. However, while the document mentions specific strategies for biogas development, not much concrete action in terms of rigorous research has been undertaken to inform the development of the sector.

The basic research and data problems are a spinoff from the inadequate financial commitment and allocation of resources to both tackle the air pollution problem and develop the biofuel sector. Apart from academic research mostly funded by external international research funders and donors, successive governments have paid lip service

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in terms of allocation of financial and material resources to fund research and interventions that will simultaneously both promote the use of biofuels and deal with the problem of air pollution which has become a major issue of public health concern. Indeed, there is need for government to commit resources to undertake air pollution monitoring, particularly in the urban areas where there is increased motorization (with overage vehicles) and improper waste disposal leading to intolerable pungent air pollution with faecal and liquid waste matter.

This lack of financial commitment can be seen in several air quality programs that have been initiated and stopped at various stages, due to a lack of financial resources. The Ghana EPA has been involved in more than 15 independent air quality monitoring programs largely with funding from international partners and donor agencies. This is because there are no government funded air quality monitoring programs, so each funding regime introduces its own air quality monitoring modalities and requirements instead of integrating them with an existing government air quality monitoring program. The current air quality monitoring program funded by World Bank & USEPA was initially covering SO_2, NO_2, PM_{10} and TSP but due to financial constraints and lack of governmental support the program only monitors PM_{10} and TSP.

Associated with the issue of finance is also the lack of technical capacity and know-how. There is lack of appropriate equipment to monitor air quality for example, and to devise strategies to undertake air quality management. At the very minimum, there is need to develop technical staff to undertake activities such as sample analysis and station maintenance.

This lack of financial capacity makes it almost impossible to plan and execute long-term nation-wide monitoring programs that will reliably generate the air quality indices required to support future formulation of environmental policies that may affect air quality. This is critical because if we are to develop the biofuels sector, we must also ensure that it is managed properly with the needed technical expertise to ameliorate potential negative side effects.

Perhaps one of the biggest challenges for the development and implementation of policies related to the environment relates to the inabilities of many sub-Saharan African governments to deal with countries such as China. China has big commercial interests in the mining and mineral sectors of most countries in the region. With large investment in these countries, including Ghana, Chinese corporations and individual Chinese mining companies are engaged in policy violations and unethical practices that are creating major problems for the Ghanaian environment.

Before concluding, we would like to point out that recently some governments in Africa have implemented policies that are aimed at addressing the issue of air pollution and traffic congestion in urban areas. One such policy that has been implemented is the Bus Rapid Transit system, which research has shown to have a wide range of benefits for improving the quality of life in cities, including reduction of greenhouse gases and local air pollution emissions (Naiker et al 2012; Wetsman 2018). However, its implementation in Africa has been fraught with challenges that will need to be addressed if it is achieve these perceived benefits. Some of these challenges include lack of political will, lack of

dedicated bus lanes and conflict between government agencies and public transport operators.

Attempts have also been made at introducing and promoting the distribution of improved cookstoves through formation of country alliances for clean cookstoves as well as the expansion of liquefied petroleum gas production facilities and distribution networks and harnessing renewable energy potential (Amegah & Jaakokola 2016). With regards to dealing with traffic emissions, Ghana has recently started a process of assessing road vehicle emissions and air pollution impacts in Accra, and other cities under the Transport Emissions Monitoring and Mitigation Project. The project involves gathering sample data on buses, taxis, cars and heavy goods vehicles with the aim of the development of standards appropriate for the country.

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