Data Needs for Better Policies on Air Pollution in Sub-Saharan Africa

Workshop Report

26th March 2021

Hosted by the University of Ghana, the African Institute for Mathematical Sciences - Rwanda, the University of Dar es Salaam, Imperial College London.

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1.0 Introduction

A workshop titled "Data needs for better policies on air pollution in Sub-Saharan Africa" was organized by the University of Ghana, the African Institute for Mathematical Sciences, the University of Dar es Salaam, and Imperial College London on Friday 26th March 2021. The objective of the meeting was to bring together stakeholders from academia, government, environmental regulatory institutions, local government authorities, research bodies, non-governmental organizations (NGOs) and civil society organizations (CSOs) from Ghana, Tanzania and Rwanda to deliberate and share knowledge on specific data needs and opportunities for improving air quality in SSA cities. The workshop was virtual and was organized via Zoom. The programme, outlined in Annex 2, involved opening remarks, country presentations, four break-out sessions and summaries after each discussion. It was moderated by PSS Urbania Consult in Ghana.

2.0 Opening

The workshop was opened with remarks by Dr. Allison F. Hughes from the University of Ghana, in collaboration with Prof Majid Ezzati from Imperial College London. In his remarks, Dr Hughes provided some statistics on the impact of air pollution from inefficient energy uses and exhaust fumes in the world. He spoke about the huge challenge represented by data gaps for adequate air pollution management and policy decision-making in African cities. He also mentioned other challenges such as lack of infrastructure and the high cost involved in the use of traditional approaches for air pollution measurement. He underscored the need to integrate traditional and modern or emerging technologies to obtain robust air quality data using remote sensing, high resolution satellite images, mobile sensors and cameras among others.

3.0 Welcome address

Hon. Mohammed Adjei Sowah, Mayor of the Accra Metropolitan Assembly, welcomed the participants to the workshop with a short address. He highlighted that the most urgent need for sub-Saharan Africa is the availability of data on air quality. The gap in data has impaired planning, policy formulation and education.

He highlighted a number of initiatives being undertaken by the city of Accra. For instance, the city authorities have been in close working relationship with the Environmental Protection Agency since the launch of EPAs strategy to improve air quality. The Mayor has permitted the mounting of two air quality monitoring devices on the roof top of the city hall to aid in the collection of real time data. Accra was one of the pilot cities for the World Health Organization's Urban Health Initiative for advocacy and community engagement to raise

awareness on the impact of air quality on health. An initiative to plant 1000 trees was also launched in partnership with the Forestry Commission of Ghana.

Mr Sowah indicated that Accra will continue to support progressive initiatives that addresses fundamental steps such as lack of data and wished participants a fruitful discussion.

4.0 Country presentations

Representatives from the environmental regulatory agencies from the three participating countries made presentations on each country experience from a regulatory perspective, touching on existing strategies, inherent challenges, and areas of potential collaboration with academia. The boxes below provide the summaries from these presentations.

Box 1: Country Presentation from Tanzania

Presented by: Befrina Igulu (Senior Environmental Inspector, The National Environment Management Council)

Tanzania has a number of legal, regulatory and institutional frameworks that support air quality management in the country. The National Environmental Management Council (NEMC) was established with the responsibility of advising government and the international community on environmental issues in Tanzania. Its key function include: i) undertaking enforcement and compliance; ii) reviewing and monitoring environmental impact assessments; iii) facilitating public participation in environmental decision-making; and iv) supervising and coordinating environmental management issues within the country.

National legislations encompass pollution limits, penalties and enforcement mechanism directed at the implementation of International Agreements. Six key environmental challenges of Tanzania are identified under the county's Environmental Policy, 1977 to include land degradation; lack of accessible, good quality water for urban and rural inhabitants; environmental pollution; loss of wildlife habitats and biodiversity; deterioration of aquatic systems; and deforestation. The policy further provides guidelines for environmental management in the country. There is the Environmental Management Act, 2004 that prohibits degradation of the natural environment (water, air and land), and promotes the protection of public health and environment. The Act is guided by a number of principles such as the precautionary principle, the polluter pays principle, principle of eco system integrity among others.

The Act together with its Regulations generally seek to prevent water, air and land degradation by ensuring that projects satisfy environmental requirements prior to approval and issuing of permits and licenses. For instance, environmental impact

assessment and monitoring of pollutants is required of all projects under the Environmental Management Act and its Regulations.

An Environmental Management (Air Quality Standards) Regulations was enacted in 2007 which provides for prevention and control of air pollution as well as the National Environmental Standards Committee (NESC). NESC among others is responsible for setting minimum air quality standards and prescribing criteria for its measurement.

In spite of the aforementioned frameworks and the mandate of the NEMC to carry out air quality monitoring at the national level, no monitoring studies are done at present.

Industries are responsible for and required to do their own air quality monitoring. In the case where the NESC feels the data being presented are inadequate, snapshot measurements are carried out.

The environmental sub-sector in Tanzania is fraught with challenges such as lack of database for cities on air quality; lack of regular monitoring by the regulatory authority, old and high energy consumption technologies, lack of funding and inadequate capacities both human and tools.

The NEMC anticipates that new academic studies can inform government policies and decisions on collaborative research works. Furthermore, training on application of emerging technologies as well as public participation is another area where academic studies can inform country policies.

Areas of potential collaborations with academia will include: developing air quality monitoring studies; implementing academic research outcomes for effective air quality control and management; sharing of air quality database and public participation and awareness creation.

Box 2: Country Presentation from Rwanda

Presented by: Juliet Kabera (Director General, Rwanda Environmental Management Authority)

Air quality management in Rwanda is the overall responsibility of the Rwanda Environmental Management Authority (REMA). It is mandated by the new Air Quality Law No. 18/2016, Law N°18/2016 of 18/05/2016 which sets out the framework for the regulation and prevention of air pollution in Rwanda, to monitor and provide air quality data for six common air pollutants from both natural and man-made sources in the country. The two pollutants of high priority concern are however, particulate matter (PM2.5) and Nitrogen oxides. The Transitional legislation: Prime Minister's Instructions

N° 005/03 of 27/12/2013 preventing air pollution caused by vehicular emissions and machines using petroleum products in Rwanda has also been enacted in this regard.

In achieving its air quality targets, the country has established twenty-two (22) ambient air quality monitoring's or reference stations and low-cost AQ Networks across the country. It planned to enhance the stations with five (5) mobile air quality monitoring, two (2) near-reference air quality station and seven (7) more low cost- air quality sensors by April 2021. The REMA has also instituted air quality mobile app, which is a web-based application system and allows for participatory monitoring of air quality by all. Rwanda has carried out its first integrated air quality monitoring project in the Country- "Rwanda Climate Observatory Project". This AGAGE station is a world-class observatory on Mt. Mugogo measuring climate change and the atmospheric species forcing climate change. The Project seek to:

- enhance capacity building for nationals in the field of Climate Change and Atmospheric Sciences. (MSc Program at UR)
- increase the number of Graduates and Researchers in Climate Change and Atmospheric Sciences
- create a Center of Excellence for Climate Change Research
- enhanced understanding of the relationship of climate with economy, environment and society
- increase ability to mainstream into government policy and to manage economy to be more resilient to climate shocks, and manage climate variability and climate change
- collaborate with International Climate Researchers and contribute to International Climate Change Policy.

Other strategies for emission control and enforcement are through vehicle inspections; car-free days, once a month on Sundays (PM 2.5 was reduced by 15% on car-free days.); E-Motors that involves scaling up of electric motorbikes; creating more green spaces; and increasing infrastructure for walking. Strict measures on importation of used vehicles to ensure old and used vehicles are able to respect the standard; ensuring smooth traffic flow around traffic hotspots through alternative by-passes as well as ensuring a seamless public transport system are ongoing in the country. Rwanda projects to scaling up E-motors to 100% of moto taxis in Kigali by 2025 to among other objectives prevent an annual 70 kilotonnes of carbon dioxide emissions and annual health benefits equivalent to 1350 Disability-Adjusted Life Years (DALYs) per year (Sudmand A, et al. International Growth Centre Policy Brief, 2020).

Rwanda underscores the need for extensive air quality monitoring covering all locations in country in order to assess long-term pollution trends. This baseline database which provides an inventory of all sources of air pollution, type and air quality control strategies is however lacking. Academic collaborations that support the development of mathematical models on air pollution; capacity building to apply Internet of things (IoT) in air pollution management; and long-term air quality and climate change data analysis,

reporting and publication will be very beneficial in overcoming this challenge and enhancing the country's air quality management efforts.

Box 3: Country Presentation from Ghana

Presented by: Emmanuel Appoh (Environmental Quality Specialist, Environmental Protection Agency, Ghana)

Air pollution is a leading cause of death in Ghana and a huge public health concern. It is estimated that all Ghanaians are exposed to $PM_{2.5}$ and that 1 out of 19 deaths in the country are related to air pollution. Ghana's major sources of air pollution are inefficient cooking methods (55%), Diesel engines (25%), open burning of solid waste (15%) and informal charcoal production (5%). Studies on air pollution in Ghana suggest that air pollution accounts for 8% of total mortality. In 2017, annual total air pollution was estimated at an average cost equivalent to 4.2% of GDP (about US$2.5B). (WHO, 2017; World Bank. Ghana Country Environmental Analysis, 2020; Stanaway JD, et al., Lancet, 2018).

The Environmental Protection Agency has the overarching responsibility of governing the preservation of air quality and prevention of air pollution. The institution works within several relevant policy, legal and regulatory frameworks to address air pollution including:

- The EPA Act 1994, Act 490; EAR 1999, LI 1652
- Hazardous and Electronic Waste Control & Management Act, 2016, Act 917 and Regulation 2250 (LI2250 operationalizes the Basel convention on trans-boundary movement of hazardous wastes and their disposal
- Ghana Standard for Environment and Health Protection – Requirements for Ambient Air Quality and Point Source/Stack Emissions (GS 1236, 2019)
- Ghana Standard for Environment and Health protection – Requirements for motor vehicle emissions (GS 1219, 2018)
- National Environmental Policy, 2014 (which recognizes air pollution as global problem with health implications)
- Local Governance Act 2016, Act 936: abate nuisances eg. open burning of wastes
- GRA Customs Division Law (Act 634) of 2012 (Age-based tax system; penalty on cost, insurance & freight of over-aged vehicles)
- Customs (Amendment) Act 2020, ACT 891 Section 154 (2). to provide incentives for automotive manufacturers and assemblers registered under the Ghana Automotive Manufacturing Development Programme (GAMDP).
- Ghana Transport Policy (2018)
- Ghana National Action Plan (NAP) to mitigate SLCP identifies 16 cross-sectors measures to control SLCPs.
- GAMA Air Quality Management Plan (AQMP) and Communication plan published by EPA Ghana.
- Published Motor Vehicle Emission Standards. Regulations are being prepared.

- Published Ambient Air Quality and Point Source/Stack Emissions standards. Regulations are being prepared.
- ECOWAS Ministers adopted a regional standard on imported gasoline and diesel fuels (max 50ppm). Ghana published sulphur in fuel standard in 2017
- ECOWAS Better Air Quality Initiative (West and Central Africa Regional Framework Agreement on Air Pollution;2009
- Ghana published national standards for biomass cookstoves.
- Commissioned Environmentally Sound Disposal and Recycling of E-Waste in Ghana to reduce pollution and dangerous toxic gases.

Even though, the country has numerous environmental policies, regulatory and legal frameworks such as listed above, these are inadequately coordinated to address air pollution and climate change issues. This problem is aggravated by the lack of substantive national policy on air pollution to give the subject more focus and priority. Moreover, the National Environmental Policy does not provide adequate information for air quality management in Ghana. Other challenges include continuous use of age-based taxation system, poor vehicle maintenance, gaps and quality of data, land use planning issues such as, the siting of industries by road sides, limited studies on source attribution, inadequate funding and logistical capacity.

Despite these challenges the EPA has 15 regulatory grade monitors located in commercial, residential and industrial areas along roads based in Accra, the capital city as well as 15 low-cost monitors for further studies.

A number of initiatives are being undertaken to reduce air pollution such as the 'Urban health and short-lived climate pollution reduction' project as well as the 'Pollution management and environmental health' project. On the subject of capacity building, there is an initiative which provides training to Ghanaian scientists and NGOs from selected organisations on household air pollution and monitoring. A number of challenges persist such as the National environmental policy not providing adequate information for air quality management in Ghana; continuous use of age-based taxation system, poor vehicle maintenance, gaps in data and limited studies on source attribution.

Opportunities exist to strengthen institutions in the regulatory framework; foster effective collaboration between regulatory institutions, academia, researchers to support data management and restructure policy in general

In the areas of academic collaboration in particular, the EPA looks forward to research works that will synchronise air pollution management mechanisms and systems in the country as well as training of students to specialize in air pollution management to beef-up the human resource capacity.

Above all, a multi sectoral approach is required in addition to proper implementation of national action plans to ensure effective air quality management in Ghana.

5.0 Break-out Sessions

Participants were put into four break-out groups to discuss into details assigned topics. Representatives from the groups reported their responses back to the plenary. A summary of the discussions is presented below:

5.1 Information needs to enhance policy design and implementation

Key information needs identified by the participants for policy design and implementation on air pollution and air quality management include:

- **Information on priority pollutants -** countries need up-to-date data on priority pollutants. In many cases, these are $PM_{2.5}$ and PM_{10} for industries and road construction sectors.

- **Sources of and specific factors contributing to air pollution -** data that provide an understanding of the sources (for example, a database of industries) and factors contributing to air pollution are key to drive targeted solutions.

- **Geographic coverage of monitoring systems and impact on air pollution data -** the locations of monitoring systems should ensure a wider geographical coverage so that activities that impact air quality in different sectors of the city (slum areas, inner cities etc.) can be adequately captured.

- **Socio-economic data on the level of exposure -** adequate data that provide information on the characteristics of the exposed population and the level of impact of air pollution in different groups are needed.

- **Data to monitor community exposure levels -** population densities affect the levels of community exposure to air pollution. Adequate data are however needed on a disaggregated basis to be able to measure community-specific exposure levels.

- **Information to bridge gap between scientists and policy makers -** there is a gap between technical and scientific researches and policy documents that policymakers need to make informed decisions. Data that bridge this gap are therefore important.

- **Data for planning and monitoring and evaluation (M&E) -** data for overall planning and M&E of air quality management are critical.

5.2 Barriers to implementation: what are the barriers to implement new policies in air pollution management?

Participants identified the following barriers that inhibit the implementation of new policies on air quality management:

- **Lack of capacity for data monitoring -** generally both technical and human resources to monitor and implement other air quality management programmes and activities are inadequate across all levels.

- **Lack of funding -** this is largely due to lack of government prioritization of air pollution issues.

- **Lack of political will to enforce air pollution regulations and standards -** this was found to be a big challenge in Ghana and Tanzania, where for instance policies to ban the use of old vehicles are still not enforced.

- **Lack of research-based decision-making -** policymakers do not have adequate and appropriate user-friendly scientific data to take informed decision on the issue.

- **Lack of appropriate local level dissemination mechanisms and communication strategy –** very little is known at grassroot level on air pollution and its consequences due to unavailability of information in user friendly languages and formats.

- **Inconsistent technologies -** there is no synergy between traditional approaches and emerging technologies that are being imported into the countries for air pollution monitoring and management.

- **Economic and cultural barriers e.g., the use of charcoal versus LPG -** countries continue to experience challenges related to the energy preferences and price. Many still use inefficient sources of energy like charcoal and firewood and old vehicles because they are cheaper. Others opt for these energy sources merely for cultural reasons.

- **Lack of M&E systems on air pollution -** not much is being documented, reported and learnt on air quality implementation and management processes so far because there are no M&E systems in place.

5.3 Unlocking the policy stream: How new information from academic studies and monitoring can help remove barriers for policy implementation?

Recommendations to remove policy barriers through academic research include:

- The need for consistent research on air pollution should be encouraged and supported.
- Academic researches on air pollution should be more action-oriented or operational.
- More collaborations and/or joint researches between academia and regulatory bodies should be fostered.
- Current academic researches and reports on air pollution in all three countries are mostly foreign. The need to localize these academic researches is therefore paramount.
- There is a need for effective collaborations between stakeholder institutions on appropriate and emerging technologies.
- Machine learning for air pollution management should be encouraged.
- Academic modelling should be more practical, pragmatic and localized to enable model usage by relevant institutions.
- Knowledge transfers and capacity building between government institutions and academia should be promoted.
- Cost-benefit analysis should be included in air pollution researches to provide adequate economic basis for policy decision making.
- Open data resources should be made available.
- Researches should be expanded to cover socio-economic impacts of air pollution to aid advocacy in the sector.
- Agencies and academic institutions should consider regional research cooperation due to the transborder nature of air pollution.

5.4 Capacity strengthening on sensing policy, data sciences and modelling, public health, environmental management

In the areas of capacity strengthening for air quality management, the following recommendations were outlined:

- Strengthen institutional collaborations with academia.
- Promote learning and local and international exchanges.
- Establish skills-based programmes to transfer knowledge.
- Promote collaborations between research organizations and other like-minded/parallel research organizations.
- Undertake project-based researches.
- Develop in-country capacities on air pollution and scenario modelling.
- Train CSOs and local groups to develop community-led strategies for air pollution management.
- Adopt citizens in science-approach to involve citizens in generating solutions for air pollution management.
- Collaborate to develop targeted Master's programmes that will support air pollution management.

6.0 Conclusion

It emerged from the discussions that air quality in Ghana, Tanzania and Rwanda is at alarming levels and is causing several deaths and public health issues. Although these countries have regulations and have adopted several strategies to manage air pollution, huge challenges still exist to obtain adequate and up-to-date data and to implement appropriate and modern technology for air quality measurement. Other challenges include lack of synergy between traditional approaches and modern technologies, lack of adequate funding and enforcement of air quality standards, as well as lack of dissemination of information in user-friendly formats.

Key recommendations included government prioritization of investments in air quality management; effective collaborations or partnerships between government regulators and academia to fill data gaps, the need for human and institutional capacity development and development of appropriate and practical models; improved media engagement and advocacy; stakeholder engagement at all levels. A key issue of trans-border air pollution and air quality management was raised, prompting further discussions among high-level stakeholders in different countries.

Annex 1- List of Participants

ATTENDANCE LIST
(Friday, 26th March, 2021)

No.	Name	Organisation	Designation
		Tanzania	
1.	Befrina Igulu	The National Environment Management Council	Senior Environmental Inspectors
2.	Jimmy Gasore	Climate Observatory Project, Ministry of Education	Chief Scientist
3.	Mary Swai	Centre for Sustainable Energy Services (TaTEDO)	Programme Manager- Bio-Energy and Climate Change
4.	Jacqueline Godfrey Mwendwa	Tanzania Industrial Research and Development Organisation (TIRDO)	Research and Development Organisation (TIRDO)
5.	Mussa Mayala Martine	Economic and Social Research Foundation (ESRF)	Research Assistant
6.	Lenin Kazoba	Tanzania Youth Coalition	
7.	Edmund Mabhuye	University of Dar es Salaam	Lecturer
8.	Jerry Hella	Ifakara Institute of Tanzania	Senior Research Scientist
		Rwanda	
9.	Karunranga Dismas	Ministry of Environment	Pollution and Waste Policy Specialist
10.	Tuyisenge Aminadab	Rwanda Meteorology Agency	Senior Forecaster
11.	Uwingabire Dieudonne	National Youth Council	Youth Representative
12.	Cyprien Ndayisaba	Rwanda Transport Development Agency	Environmental Specialist
13.	Juliet Kabera	Rwanda Environmental Management Authority	
14.	Jacques Nsengiyumva	Rwanda Environment Management Authority	
15.	Oscar Nzabonimpa	Rwanda Environmental NGOs Forum	

16.	Isambi Mbalabasta	AIMS	Research and Scientific Development Manager
17.	Murera Gisa	AIMS	Researcher
18.	Wilfred Ndifon	AIMS	Chief Scientific Officer
19.	Bright Abboh	AIMS	Researcher
20.	Egide Kalisa	University of Rwanda	Researcher
21.	Jean Claude Nyirimanzi	National Institute for Statistics	
22.	Alphonsine Mukamunana	Ministry of Health	
		Ghana	
23.	Mr. Kenneth Nana Amoateng	AbibiNsroma Foundation (ANF)	CEO
24.	Mayor M. Adjei Sowah	Accra Metropolitan Area	Mayor of Accra
25.	Daniel Essel	Ministry of Transport	Deputy Director
26.	Adam Abdul Fatah	Federation of Youth Clubs (FYC)	Executive Director
27.	Dakuu Gordon	WHO Ghana Office	National Programme Officer
28.	Thomas Dettoh	Ga South Municipal Assembly	Head, Physical Planning Department
29.	Naomi Kumi	Department of Geographic Science, University of Energy and Natural Resources	Lecturer
30.	Kofi Kekeli Amedzro	Land-use and Spatial Planning Authority	Senior Planner
31.	Jerry Kekeli	Ghana health service	
32.	Emmanuel K.E. Appoh	EPA	Head of Policy Research
33.	Desmond Appiah	AMA	Director of Sustainability
34.	Kisses Johnson	Ghana Health Service	
35.	Allison F. Hughes	University of Ghana	Senior Lecturer/ Researcher

36.	Samuel Agyei-Mensah	University of Ghana	Professor
37.	Elvis Kyere-Gyeabour	University of Ghana	PhD student
		UK	
38.	Sierra Clark	Imperial College London	PhD student
39.	Giulia Mangiameli	Imperial College London	Project Manager
40.	Majid Ezzati	Imperial College London	Professor
41.	Benjamin Barratt	Imperial College London	Reader
42.	Barbara Metzler	Imperial College London	PhD student
		US	
43.	Raphael Arku	University of Massachusetts	Assistant Professor

Annex 2

Data needs for better policies on air pollution in Sub-Saharan Africa

Virtual Workshop

Ghana, Rwanda, Tanzania

Time	Activity	Objective	Responsible
9:00 am	Opening activities	Warm up and call to order	Moderator
9:05 am	Welcoming and project introduction	Brief introduction of project and purpose of gathering	Majid and Allison
9:15 am	Welcome remarks	Welcome remarks by the Mayor of Accra	Mayor of Accra
Session 1			
	Presentations by Environmental Agencies on Exhibiting Regulations and Policy opportunities for air pollution management	Sharing of country experiences on policies and regulations on air pollution management. 1) current policies on air pollution; 2) current monitoring studies at country level and major challenges of air quality monitoring and pollution reduction in the respective cities; 3) how new academic studies can help inform country policies and areas for collaboration with academic researchers.	
9:20	Tanzania country experience		Tanzania Rep
9:35	Rwanda country experience		Rwanda Rep
9:50	Ghana country experience		Ghana Rep

10:05	Questions and answers	Opening the discussion for any clarifications	Moderator
10:10	10-min Break	Stretch out break	All
10:20	Discussion	Breakout groups on information needs to enhance policy design and implementation POLL questions	Moderator and group moderators
11:00	Summary of the discussion	Presentations from the group sessions	Group moderators
11:20	Main Break (40 min)	Long Break	All
Session 2			
12:00	Discussion	Breakout groups on barriers to implementation: what are the barriers to implement new policies in air pollution management?	Moderator and group moderators
12:40	Summary of the discussion	Presentations from the group sessions	Group moderators
12:50	Discussion	Breakout groups on unlocking the policy system: how new information from academic studies can help remove barriers for policy implementation?	Moderator and group moderators
13:30	Summary of the discussion	Presentations from the group sessions	Group moderators
13.40	5-min Break	Stretch out break	All

13:45	Plenary	Plenary discussion on capacity strengthening on sensing, policy, data science and modelling, public health, environmental management	Moderator
14:10	Summary of the discussion		Moderator
14:15	Closure		Moderator and academic team