



**Institute for Water
and Energy Sciences**



Pan African University Institute for Water and Energy Sciences (Incl. Climate Change)

– PAUWES –

&

The Young Earth System Scientists (YESS) Community

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**Sustainable Development in Africa - Shaping the Future of the
Continent on Water, Energy and Climate Change Issues**

Technical Report

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Lead Authors:

Brian Omondi Oduor, Faten Attig Bahar, Rondrotiana Barimalala, Claudia Volosciuk

Contributing Authors:

Axel Nguedia Nguedoung, Margaret Koli, Janvier Kamundala, Anthony Osinde, Frances Gbolare Awunor, Isa Elegbede, Modathir Zaroug

Editors:**Prof. Abdellatif Zerga**

The Director,
Pan-African University Institute of Water
and Energy Sciences (incl. Climate Change)
(PAUWES)
c/o Tlemcen University, B.P. 119 Pôle
Chetouane, Tlemcen 13000, Algeria

Dr. Erick Gankam Tambo

Research Coordinator
Pan-African University Institute of Water
and Energy Sciences (incl. Climate Change)
(PAUWES)
c/o Tlemcen University, B.P. 119 Pôle
Chetouane, Tlemcen 13000, Algeria

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- The United Nations University, Institute for Environment and Human Security (UNU-EHS)

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Overview of the YESS-PAUWES Webinar Series

Author: Brian Omondi Oduor^{1,2}

Affiliations:

¹*Pan African University Institute of Water and Energy Sciences (incl. Climate Change) (PAUWES)*

²*United Nations University Institute for Environment and Human Security (UNU-EHS)*

Abstract

The Young Earth System Scientists, YESS-community (YESS Africa Team) and the Pan-African University, Institute of Water and Energy Sciences (including Climate Change) (PAUWES) Community of Practice (CoP), with the contribution of Future Earth's Food-Water-Energy Nexus Knowledge-Action-Network (Nexus KAN) and the United Nations University Institute of Environment and Human Security (UNU-EHS), conducted their first edition of the webinar series on Sustainable Development in Africa on the role of science and social engagement in shaping the future of the continent. The initiative included a series of webinar sessions aimed at enhancing collaboration and networking between researchers of the two communities (YESS and PAUWES) and other scientists within the continent. The sessions were carried out between December, 2018 and June, 2019 with the main target participants being PAUWES students and YESS members. It thus brought together scientists, stakeholders and the fresh vision of Early Career Researchers (ECRs) under the same umbrella to drive the sustainable development of the continent.

1- Introduction and background

Africa is the second largest continent in the world and covers approximately 20 percent of the Earth's land surface, contributing to about 16.64 percent (Worldometers, 2019) of the total world population. The continent is very rich in history, resources, languages, biological and geographical diversities. It is also a host of multiple indigenous animals, insects and plants species. However, Africa is referred to as the least developed continent with a very high level of poverty, social inequality and infrastructure decay Africa is, in fact, widely recognized to be one of the most vulnerable regions to extreme weather and climate change impacts (Niang, *et al.*, 2007; Boko, *et al.*, 2014). Yet the continent has a low adaptive capacity. The state of natural disasters in Africa portends a great challenge to its sustainable development and also represent a big threat to biodiversity balance, food security and water access. The number of reported disasters, particularly those related to climate change and extreme weather events, has significantly increased in recent decades throughout the continent (Hallegatte, *et al.*, 2016). Understanding the impact of climate change, climate variability, and extreme events on the livelihood of the continent will help to develop the continent's adaptation strategy and forestall the occurrence of frequent high risks. Defining a pan-African roadmap for sustainable development in the continent should involve strong willingness and eagerness.

The Pan African University Institute of Water and Energy Sciences (including Climate Change) ([PAUWES](#)) is one of the five hubs of the Pan African University (PAU) and is hosted at the University of Tlemcen in Algeria. The Pan African University (PAU) is a flagship project of the Agenda 2063 of the African Union Commission (2013) that was initiated with the objective to promote higher education, science and technology on the African continent at a high academic level. PAUWES holds a unique position in understanding the pan-African dimension of scientific problems and is especially suited to find solutions to the challenges faced in different African countries with regards to water, energy and climate change. Consequently, PAUWES is developing strategies for tapping into the advantage of its Pan- African perspective without losing focus on specific national and regional problems.

The Young Earth System Scientists (YESS-community) is a network of young scientists that unifies international and multidisciplinary early career researchers in a powerful network, providing a voice and leverage for a better future to serve society. The YESS community is represented in 84 countries counting more than 1400 members. YESS focuses on researchers working in the interdisciplinary field of Earth system sciences, including social and natural scientists.

Both the YESS-community and the PAUWES Community of Practice are sharing the same vision on the necessity of providing opportunities to empower the new generation of scientists (and practitioners) with an open international pan-African mindset and a desire to tackle the emerging problems for their continent and can contribute together for the well-being of the African society by providing a better understanding of aggravated damages, particularly on water, food and energy availability due to extreme weather and climate events.

For this webinar series, the challenges and opportunities for sustainable development in Africa were discussed while stressing the role of the social engagement and the role of science in shaping the future of the continent. This initiative brought together scientists, stakeholders and the fresh vision of Early Career Research Scientists (ECRs) under the same umbrella to drive the sustainable development of the continent.

Focus was particularly given to food, water, energy availability as well as to the adaptation strategy to extreme climate and weather events. Discussion between experts in different fields, stakeholders and Early Career Researchers was also promoted. The webinars and all discussions were open to the public. In addition to its originality, this project showed particular example of how to reduce carbon footprint and enables interaction across regions and cultures through a fully online event.

2- Project summary

The proposed project aimed to bring together natural scientists, social scientists and stakeholders to discuss about the role of science and social engagement in shaping the future of Africa through an effort to achieve Sustainable Development Goals (SDGs). Knowledge transfer, discussion

between experts in different fields, stakeholders and Early Career Researchers (ECRs) will be promoted. The project consisted of a series of webinars conducted by experts from various disciplines dealing with the challenges facing the sustainable development in Africa. Each webinar session lasted for 30 minutes, which was followed by another 30 minutes of discussion session. The webinars and all discussions were open to the public with ECRs, particularly from YESS Community and PAUWES CoP being the bulk of the participants.

The first webinar of the series was on “*Integrative Pathways for Poverty Reduction Job Creation, Climate Change and Environmental Management*” presented by Mr. Peter Akari from PAKARI Associates Limited in Accra, Ghana, and a former Chief Policy Officer at the African Development Bank. The presentation focused on sustainable development and its desired outcomes with an emphasis on water, energy and food security in Africa. Also discussed was the sustainable development blueprint frameworks which includes the African Union’s Agenda 2063 on “The Africa We Want” which is a strategic framework for the socio-economic transformation of Africa over the next 50 years and the United Nations “2030 Agenda for Sustainable Development Goals (SDGs)” (UNSTATS, 2018) which has established 17 Goals that provide a universal call to action to end poverty, protect the planet and ensure that all people can enjoy peace and prosperity. Presentation was also made on integration of environmental protection, economic development and social development as the desired pathways to accelerate the implementation of Agenda 2063. Discussion was also made on how to address the nexus of water, energy and food jointly as it is key to the realization of sustainable development (FAO, 2014). In conclusion, effective and diverse coalitions of the various ministries, civil society and private sector institutions, communities and the public at large are needed so as to achieve the goals of Agenda 2063 and SDGs in Africa.

The second webinar was on “*How Africa’s Future would be shaped by Air Quality*” presented by Prof. Kobus Pienaar from North-West University, South Africa and a member of the Scientific Steering Committee of the World Meteorological Organization’s Global Atmosphere Watch Programme. The presentation highlighted the importance of air quality in sustainable future development in Africa considering that many infant mortalities in Sub-Saharan Africa have been attributed to air pollution (Heft-Neal, *et al.*, 2018). It was highlighted that the major factors influencing air quality in Africa are biomass burning, sand and dust storms and energy production. The gaps and measures for mitigating air quality impacts were also extensively discussed. Emphasis was made on not only improving on data availability and forecasts but also ensuring effective communication to the affected population. An integrated approach was recommended to effectively tackle air pollution and its impacts. It was also discussed how compliance with good air quality policies already being in place could be improved where raising awareness by experts including early career researchers was identified as a major activity. It was concluded that early career scientists could play an active role in advancing knowledge, identifying solutions, and the effective communication of air quality.

The third webinar was on *"Chances and Challenges of Sustainability Science for Africa's Development"* presented by Dr. Cheikh Mbow, the Executive Director of START-International in Washington, Adjunct Professor of Forestry at Michigan State University, and the Coordinating Lead Author IPCC. The presentation explored the opportunities and challenges related to connecting technology innovation to sustainable development; analyzing the leverage points to unlock opportunities for integrated impactful solutions; and demonstrating leadership in sustainable development through sustainability science. Additionally, the importance of creating actions in order to achieve transformation and the spur SDGs in Africa, which remain very challenging was explored. It was noted that an innovative bottom-up approach was needed based on the actual problem in Africa in order to successfully achieve the SDGs (Jaiyesimi, 2016). Nevertheless, investment in science, research and development is required and ensuring that they are designed in accordance to the continent's needs by connecting social and scientific practices; that is, moving research from "impact factor" to "impact actor" and ensuring that it serves the needs of the local community and society. In overall, it was concluded that the SDGs elements alone are not enough to create continent's transformation, but there should also be the implementation of "**missing SDGs**" such as governance, structures, institutions, and funding.

The fourth and final webinar of the series' first edition was on *"The Digital Explosive Technology in the 4th Industrial Revolution in the African Context"* presented by Prof. Mammo Muchie from DST/NRF SARChI Chair in Tshwane University of Technology, South Africa, and an Adjunct Professor, BDU & TMDC at Oxford University. Focus of the presentation was on the opportunities, challenges and dangers of digital technologies which are quickly spreading across Africa, even though there is still lack of clear policies and regulations on how it's controlled. It was noted that there was a gap between technology and society since technology advances in an exponential rate whereas human institutions and society do not change so fast (Schwab, 2016). Schwab noted that the industrial revolution has changed the way we live, work and relate to one another. Highlighted was the need to intelligently apply digital technologies to make integrated, united, smart, green, innovative and social entrepreneurial Africa so as to ensure we deliver African Union's Agenda 2063, Sustainable Development Goals for Africa and STISA 2024. Broadly, the transformational technologies discussed encompassed computational systems, networks and sensors, artificial intelligence, robotics, biotechnology, synthetic biology, bioinformatics, 3-D printing, human-machine interface, among many others. It was concluded that there was a need for active engagement by promoting the public oversight of the explosive technology to create opportunities and not dangers to Africa.

3- Implementation

The project was implemented by the Young Earth System Scientists community (YESS-community) and the PAUWES Community of Practice (CoP) located in Tlemcen Algeria. The PAUWES CoP team was responsible for the technical support such as establishment of the webinar link, recording and uploading the webinar, communication of the event and mobilization of the

participants whereas the YESS Community team were involved in the organization and planning of the event through engaging and contacting the speakers, and the dissemination of the webinar recordings through their YouTube channels. The key project partners included the Future Earth Nexus Knowledge-Action-Network (FE Nexus KAN) who helped in the communication of the event and the Pan African Cooperation and Educational Technologies (PACET) programme of the United Nations University Institute of Environment and Human Security (UNU-EHS) who provided the adobe connect platform for hosting the webinar series in addition to sponsoring the publication of the proceedings.

4- Conclusion

Some of the notable outcomes from this initiative included the webinar recordings which were shared with the public through YouTube channels and in both the YESS community and PAUWES CoP platforms. The webinar reports and presentation slides which provided details of each webinar's discussion were compiled and shared online, as well as sessional papers/articles of the webinar proceeding which were published as scientific output of the project. Additionally, the capacity of attendants was enhanced by equipping them with novel knowledge on sustainable development in Africa.

The first edition of the YESS-PAUWES webinar series was a success as it achieved its intended goals and objectives. Vital lessons on sustainable development in Africa and how science and social engagement could be used in shaping the continent's future were learnt. Moreover, new networks and collaborations with other scientists across the continent were made hence contributing to the integration of both PAUWES and YESS community into scientific networks in Africa. The webinar series strengthened the cooperation between the PAUWES CoP and the YESS community, in addition to contributing to building the capacities of their members. Future collaborations were agreed upon building on this successful initiative with the rolling out of another phase of the webinar series being the next step.

References

- African Union Commission. (2013). *Agenda 2063: The Africa We Want*. Addis Ababa: African Union. URL: <https://au.int/en/agenda2063> (accessed 06.11.19).
- Boko, M., Niang, I., Nyong, A., Vogel, C., Githeko, A., Medany, M., Osman-Elasha, B., Tabo, R. and Yanda, P. (2007). *Africa. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC)*. Cambridge University Press, Cambridge UK, pp 433-467. <https://www.ipcc.ch/site/assets/uploads/2018/02/ar4-wg2-chapter9-1.pdf>

- FAO (2014). The Water-Energy-Food Nexus. A New Approach in Support of Food Security and Sustainable Agriculture. Rome: Italy. URL: <http://www.fao.org/3/a-bl496e.pdf>
- Hallegatte, S., Bangalore, M., Bonzanigo, L., Fay, M., Kane, T., Narloch, U., Rozenberg, J., Treguer, D., and Vogt-Schilb, A. (2016). Shock Waves: Managing the Impacts of Climate Change on Poverty. Climate Change and Development Series. Washington, DC: The World Bank. URL: <https://doi.org/10.1596/978-1-4648-0673-5>
- Heft-Neal, S., Burney, J., Bendavid, E., & Burke, M. (2018). Robust Relationship between Air Quality and Infant Mortality in Africa. *Springer Nature*. Vol. 559, (7713): 254-258. URL: <https://doi.org/10.1038/s41586-018-0263-3>
- Niang, I., Ruppel, O.C., Abdrabo, M.A., Essel, A., Lennard, C., Padgham, J., and Urquhart, P. (2014). Africa. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. *Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1199-1265. https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-Chap22_FINAL.pdf
- Rotimi Jaiyesimi. (2016). The Challenge of Implementing the Sustainable Development Goals in Africa: The Way Forward. *African Journal of Reproductive Health September 2016 (Special Edition on SDGs)*. Vol. 20(3): 13-18. URL: <http://www.bioline.org.br/pdf?rh16029>
- Schwab, K. (2016). The Fourth Industrial Revolution. World Economic Forum. URL: <https://www.weforum.org/about/the-fourth-industrial-revolution-by-klaus-schwab>
- UNSTATS. (2018). Zero Hunger: Goal 2 - End Hunger, Achieve Food Security and Improved Nutrition and Promote Sustainable Agriculture. *Sustainable Development Goals*. Statistics Division: United Nations. URL: <https://unstats.un.org/sdgs/report/2016/goal-02/>
- Worldometers. (2019). Africa Population (Live) 2019. <https://www.worldometers.info/world-population/africa-population/> . (Accessed: 22.09.2019).

Practical and Modern Development Approaches to Sustainable Development in Africa

Author: Faten Attig Bahar^{1,2,3} and Claudia Volosciuk^{3,4}

Affiliations:

¹*Chair of Wind Energy Technology. Faculty of Mechanical Engineering and Marine Technology. The University of Rostock. Germany*

²*Future Earth Water-Energy-Food-Nexus Knowledge-Action Network (Nexus KAN)*

³*Young Earth System Scientists (YESS) Community*

⁴*Research Department, World Meteorological Organization*

1- Introduction and background

This paper summarizes the first webinar in the series on sustainable development in Africa, organized by the YESS-PAUWES initiative and was on “*Integrative Pathways for Poverty Reduction, Job Creation, Climate Change and Environmental Management*” presented by **Mr. Peter Akari**. In the webinar, integrative pathways for sustainable development in Africa were discussed with an emphasis on water, energy and food security.

The introductory presentation outlined practical modern development approaches that integrate the key issues of the present time. The emphasis was on water, energy, food security and how these influence poverty reduction, job creation, climate change and environmental stress. Sustainable development frameworks such as the African Union’s Agenda 2063 (African Union Commission, 2013), the United Nations “2030 Agenda” (UN General Assembly, 2015) and the role of the nexus water food energy as a key driver to sustainable development were explained.

Overall, effective and diverse coalitions and efforts from different actors including the public sector, civil society, the private sector institutions, local communities and the young generation are necessary to achieve the transformation and reach the goals of the 2063 and 2030 agendas.

2- Importance of sustainable development in Africa

For so long, Africa as a whole has been and is still often being referred to as an under-developed continent, regarding economy and business, politics and governance, as well as education and infrastructure development. In most countries of the continent, the high level of poverty, social inequality, lack of access to potable water and energy, escalating cases of hunger and malnutrition and a high prevalence of infrastructure decay have become significant (The World Bank, 2019). In fact, Africa suffers from an imbalance between the demand for freshwater and its availability. This imbalance influences the agriculture sector since more than 80 percent of freshwater is used for agriculture (Khokhar, 2017) and, as a consequence, food security. By 2050, the situation may become more challenging as feeding a continent of a projected population of 2.4 billion will require

much more water resources. Additionally, the access to electricity is very limited, for example, in 2016, the electrification rate in the sub-Saharan region was only 42 percent (Adegoke, 2018).

The paradox is that Africa is a poor continent despite being very rich in resources such as diamonds, sugar, salt, gold, iron, cobalt, uranium, copper, bauxite, silver, petroleum, and cultivated crops like cocoa beans, tropical fruits, etc. (McDaniel, *et al.*, 2012). Therefore, the emphasis in the presentation was on environmental and natural resource management since the principal sources to drive development in Africa comprise: land and soils, forests, fisheries, water and biomass. Investments in sustainability yield high rates of social and economic returns and have a direct and indirect positive impact on poverty reduction.

3- Practical approaches to sustainable development in Africa

Two definitions were used to introduce sustainable development: the first was that sustainable development is a system approach to growth and development. In this particular approach, the idea is to manage natural, produced and social capital for the welfare of the present and future generations. This definition is from the principles of Social Justice. On the other hand, the official definition of sustainable development given by the 1987 Brundtland report is that, it is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Following these definitions, sustainable development should involve both improving lifestyles such as access to clean water and air, food and health security, and preserving natural resources and ecosystems. Those desired outcomes from the sustainable development were also well figured in all blueprints such as the African Union's Agenda 2063 and the UN 2030 agenda for Sustainable Development Goals (SDGs).

The strategies of resource management and sustainable development in Africa are present in different levels, and some countries show a good commitment in adopting successful approaches with a positive impact on the water-food-energy nexus and joined the global effort on fighting climate change. For instance, Ethiopia has just completed the Reppie thermal plant, Africa's first waste-to-energy plant, which incinerates 1,400 tonnes of waste per day. In Addis Ababa, 80 percent of the waste is converted into electricity for three million people. The Reppie plant does not just clean up the environment but provides much needed energy for the city. Furthermore, Morocco is currently leading in solar energy in Africa: In 2018, 32 percent of Morocco's energy demand came from renewable sources, this is expected to reach 42 percent by 2020. Morocco is also investing nine billion US dollars in the Ouarzazate Solar Power Station (OSPS) in the Drâa-Tafilalet region. Currently, this power station produces electricity for over one million homes. There are also some other initiatives such as the World Bank - International Finance Corporation (WB-IFC) light Africa Programme, USAID's Power Africa Programme (The World Bank, 2010).

4- The role of early career scientists in sustainable development

In a previous United Nations report, it was indicated that about 60 percent of Africa's population are youths under the age of 24 years (UN-DESA, 2017). By 2030, the number of youths is projected to increase by about 42 percent. This young generation could probably be that positive and driving force for the continent's development when provided with the knowledge and opportunities they need to prosper. In particular, the early career scientists and professionals involved in PhD and Master's programs in different fields of fundamental and applied sciences can apply their knowledge in their countries for a sustainable development and contribute in a productive economy.

Inviting the young generation and having their proactive engagement to be part of the discussion and have a voice in all these important problems related to the continent is very crucial. Within the African Union, there are some strategies aiming to involve the youth for important discussions, for instance, the youth division initiated by the African Union that aims to promote the presence and the participation of youth at the African Union's events and forums (African Union Commission, 2009). However, these efforts could be broadened.

5- Conclusion

To achieve sustainable development in Africa, effective and diverse coalitions of various ministries, civil society and private sector institutions, communities and the public at large are required. The Agenda 2063 and SDGs call on everyone to ensure that economic development is inclusive, improves the well-being for boys and girls, women and men and is sustained within environmental limits. Many countries in Africa (like Ethiopia and Morocco) have already made important steps towards sustainable development and these examples can be upscaled and help to inspire efforts in other countries.

Webinar speaker:

Mr. PETER AKARI is a professional Civil Engineer with more than 30 years of work experience in the conception, development, operation and management of infrastructure schemes. His key competencies include infrastructure policy and strategy development, institutional development, project development and management. He is also well versed in utility management. Mr Akari's work life has brought him from national institutions (Ghana Water Company) to international organizations (World Bank and African Development Bank); where he has held senior positions and assumed lead responsibility for a variety of innovative infrastructure endeavors, some of which have resulted in paradigm shifts in development policy. His experience has provided him with knowledge and appreciation of the complex social and economic cross-pressures associated with the pursuit of sustainable development activities.

References

- Adegoke, Yinka. (2018). The household electrification rate in sub-Saharan Africa is the lowest in the world. *Quartz Africa*. URL: <https://qz.com/africa/1271252/world-bank-recommendations-on-electricity-in-sub-saharan-africa/> (accessed 06.11.2019).
- African Union Commission. (2009). African Union: Youth Division. Addis Ababa: African Union. URL: <https://au.int/en/youth-division> (accessed 14.11.19).
- African Union Commission. (2013). Agenda 2063: *The Africa We Want*. Addis Ababa: African Union. URL <https://au.int/en/agenda2063> (accessed 06.11.19).
- Khokhar, Tariq. (2017). Chart: Globally, 70% of Freshwater is Used for Agriculture. *World Bank Blogs*. URL <https://blogs.worldbank.org/opendata/chart-globally-70-freshwater-used-agriculture> (accessed 06.11.2019).
- McDaniel, M., Sprout, E., Boudreau, D., Turgeon, A. (2012). Africa: Resources. Washington, D.C: National Geographic Society. URL: <http://www.nationalgeographic.org/encyclopedia/africa-resources/> (accessed 06.11.2019).
- The World Bank. (2019). The World Bank in Africa. *Africa Overview*. Washington, D.C: World Bank URL: <https://www.worldbank.org/en/region/afr/overview> (accessed 06.11.2019).
- The World Bank. (2010). Towards a New Energy Strategy. Washington, D.C: World Bank. http://siteresources.worldbank.org/EXTESC/Resources/EnergyStrategyPPT_SriLanka29Apr2010.pdf?resourceurlname=EnergyStrategyPPT_SriLanka29Apr2010.pdf (accessed 18.11.2019)
- UN General Assembly. (2015). Transforming our world: the 2030 Agenda for Sustainable Development, *A/RES/70/1*. United Nations. URL: <https://sustainabledevelopment.un.org/post2015/transformingourworld> (accessed 06.11.2019).
- United Nations Department of Economic and Social Affairs (UN-DESA). (2017). World Population Prospects: The 2017 Revision. New York: United Nations. URL: <https://www.un.org/development/desa/publications/world-population-prospects-the-2017-revision.html> (accessed 06.11.2019).

How Will Africa's Future be Shaped by Air Quality?

Author: Claudia Volosciuk^{1,2} and Faten Attig Bahar^{2,3,4}

Affiliations:

¹*Research Department, World Meteorological Organization*

²*Young Earth System Scientists (YESS) Community*

³*Chair of Wind Energy Technology. Faculty of Mechanical Engineering and Marine Technology. The University of Rostock. Germany.*

⁴*Future Earth Water-Energy-Food-Nexus Knowledge-Action Network (Nexus KAN)*

1- Introduction and background

Africa is a beautiful diverse continent with huge natural resources but also enormous social challenges. Despite its resources and old history of humankind, poverty and bad living conditions face a large percentage of the population. The average life expectancy in 2015 of Africans (61.5 years) is more than 10 years lower than the world average (71.4 years) (UN-DESA, 2017). One of the main factors responsible for the large mortality rate in Africa is surprisingly not diseases, malnutrition or bad water quality but poor air quality (OECD, 2016). In particular, fine particles with a diameter of less than 2.5 micrometers (PM_{2.5}) are responsible for an estimated 22% of infant deaths in sub-Saharan Africa (Heft-Neal, *et al.*, 2018). These facts are not surprising if we take into account that an average human inhale about 10 cubic meters of air per day, which translates to roughly 12.7 kg of air and compare it with the 2.5 kg of liquids and 1.5 kg of food consumed per day. Likewise, the well-being of many animals and plants depends on the air quality. Despite these facts, many Africans consider food, water and shelter of a higher priority than clean air. In this webinar, an overview of the air quality and the potential impact on the well-being and future of Africa were discussed.

2- Importance of air quality for sustainability development of Africa

A global map shows that Africa is among the regions with highest PM_{2.5} concentrations, and thus, poor air quality. Studies by Heft-Neal, *et al.* (2018) have shown that air pollution is killing a large number of young children in Africa. Many children growing up in Africa are exposed to high levels of air pollution due to various natural conditions and social practices unique to this continent. The extent of the problem is not well documented due to the available data being sparse and incomplete. The major factors influencing air quality in Africa are biomass burning, sand and dust storms, and energy production.

Current challenges to efficiently tackle air pollution in Africa were summarized in this webinar. For instance, high quality data on air quality on appropriate spatial and temporal scales is often not available. And even where this data is available, effective communication and interpretation by experts is in many cases lacking. Knowledgeable and affected parties are often poorly coordinated. For example, in South Africa, there are currently almost 130 government owned air quality stations

of which only 50 are reporting live to the South African Air Quality Information System (SAQQIS) but data quality is in many cases poor and the interpretation thereof lacking (Tshehla and Wright, 2019). Large areas are also uncovered. Prof. Pienaar emphasized that in addition to improving data availability and forecasts, their effective communication to the affected persons is also extremely important.

3- Integration of air quality to sustainable development in Africa

When speaking about shaping the future of the African continent, it is indispensable to tackle air pollution as one of the main factors responsible for the large mortality rate in Africa. Air quality is related to several Sustainable Development Goals (SDGs) (UN General Assembly, 2015).

In many African regions (such as the Sub-Saharan region), the poor air quality leads to serious impacts on human health (SDG3) and causes the death of many children. To effectively protect their health, information availability including access to warnings of high pollution episodes is crucial. City dwellers face many environmental challenges due to mainly to air pollution and weather, climate and water-related hazards, and are therefore particularly affected. WMO is promoting safe, healthy and resilient cities (SDG11) through the development of Urban Integrated Weather, Environment and Climate Services. The aim is to build urban services that meet the special needs of cities through a combination of dense observation networks, high-resolution forecasts, multi-hazard early warning systems, disaster management plans and climate services. This approach gives cities the tools they need to reduce emissions, build thriving and resilient communities and implement the SDGs. Deposition of pollutants affects food security (SDG2) and terrestrial life (SDG15) through drying of leaves, retarding the growth of plants and crop damage. Impacts on aquatic life (SDG14) include suspended dust particles in water obstructing the penetration of sunlight into the water body and hence affecting the marine life cycle.

Air pollution and climate change (SDG13) are closely connected as many air pollutants, such as tropospheric ozone or aerosol, have direct or indirect impacts on climate (World Meteorological Organization, 2019).

A major challenge in communicating air pollution is that it is often not perceived as a major problem. It is also important to understand the drivers of air pollution sufficiently well to successfully intervene to improve ambient and indoor air quality. One needs to:

- Understand the current status of air quality
- Understand the variability of air quality in the area
- Understand the use of fuel mix combustion conditions
- Intervene to modify the behaviour of burning (e.g. the insulation of houses)
- Investigate the introduction of clean stoves and clean fuels

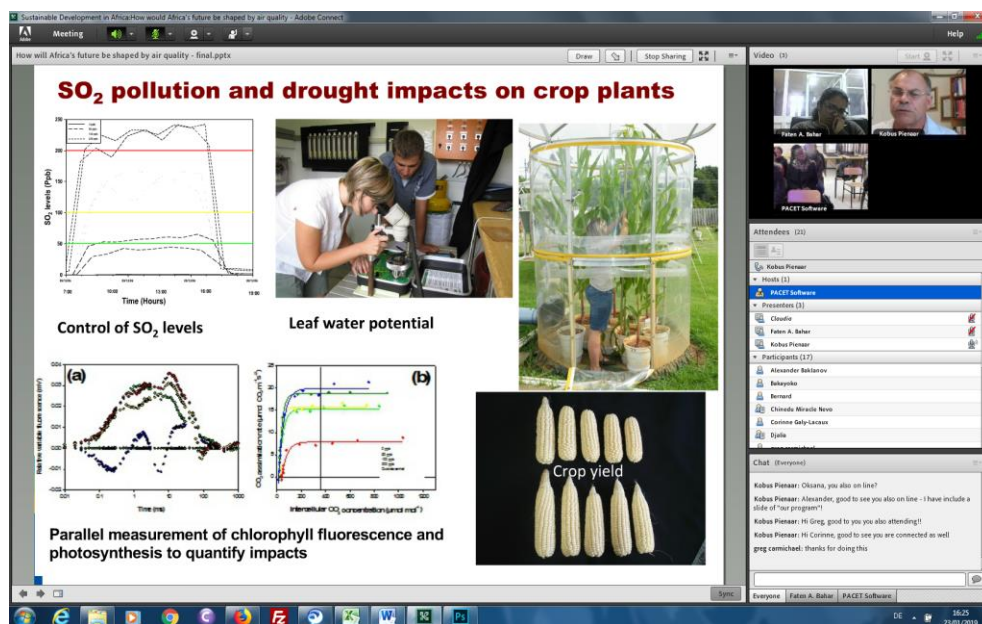


Figure 1: Webinar session by Prof. Pienaar explaining the impacts of SO_2 pollution and drought on crop plants

Prof Pienaar introduced the “Offset Project” in South Africa as an example that started as a pure air pollution study but has shown that an integrated approach is required due to the air pollution problem being linked to many disciplines, including energy supply, human behaviour, urban infrastructure, service delivery, service affordability, human health, and communication.

4- Contribution of early career scientists in air quality

“Knowledge is power. Information is liberating. Education is the premise of progress, in every society, in every family” -Kofi Annan

Early career scientists can play an active role in advancing knowledge and identifying solutions. Moreover, the early career scientists can contribute to the effective communication of the problem itself and solutions to the problem. The development of appropriate tools tailored to different users is important to make existing information accessible and understandable in collaboration with a wide range of different user groups. Early career scientists could play an active role in increasing the availability and dissemination of high-quality data on air quality on appropriate spatial and temporal scales. Discussions on how compliance with good air quality policies already in place could be improved where raising awareness by experts including early career researchers was identified as a major activity.



Figure 2: Webinar session by Prof. Pienaar addressing the future projections in air quality

5- Conclusion

To effectively tackle air pollution and its impacts, an integrated approach is required. This includes increasing availability, effective communication and interpretation of high-quality data on air quality. Furthermore, information and education are indispensable to bridge knowledge gaps and raise awareness. This enables people to both effectively protect themselves and implement sensible adaptation and mitigation measures.

Webinar speaker:

Prof. Jacobus J. Pienaar from the North-West University in South Africa is an extraordinary professor in Environmental Sciences and Management. Among his many achievements, he received the National Association for Clean Air Innovators Award in 2004 for his contribution to build capacity and advance the knowledge of atmospheric chemistry in South Africa and abroad. He has served in many international committees and is now a member of the Scientific Steering Committee on the Environmental Pollution and Atmospheric Chemistry of World Meteorological Organization (WMO).

References

- Heft-Neal, S., J. Burney, E. Bendavid, M. Burke. (2018). Robust Relationship between Air Quality and Infant Mortality in Africa. *Nature*. Vol. 559(7713): 254-258.
<https://doi.org/10.1038/s41586-018-0263-3>

- OECD. (2016). The Cost of Air Pollution in Africa. *OECD Development Centre Working Paper No. 333*. Paris: OECD Publishing. URL: <https://doi.org/10.1787/5jlqzq77x6f8-en>.
- Tshehla C, Wright CY. (2019). 15 Years after the National Environmental Management Air Quality Act: Is legislation failing to reduce air pollution in South Africa? *South Africa Journal of Science*. Vol.115 No. 9/10. <https://doi.org/10.17159/sajs.2019/6100>
- UN General Assembly. (2015). Transforming our world: the 2030 Agenda for Sustainable Development, *A/RES/70/1*. Washington, DC: United Nations. URL: <https://sustainabledevelopment.un.org/post2015/transformingourworld>
- United Nations, Department of Economic and Social Affairs (UN-DESA), Population Division (2017). World Mortality 2017 – Data Booklet (ST/ESA/SER.A/412). New York: United Nations. URL: <https://www.un.org/en/development/desa/population/publications/>
- World Meteorological Organization. (2019). Air Pollution and Climate Change, in: WMO Statement on the State of the Global Climate 2018, WMO-No. 1233. Geneva: World Meteorological Department. URL: <https://public.wmo.int/en/our-mandate/climate/wmo-statement-state-of-global-climate>

Chances and Challenges of Sustainability Science for Africa's Development

Author: Faten Attig Bahar^{1,2,3} and Rondrotiana Barimalala^{2,4}

Affiliations:

¹*Chair of Wind Energy Technology, Faculty of Mechanical Engineering and Marine Technology, The University of Rostock, Germany*

²*Future Earth Water-Energy-Food-Nexus Knowledge-Action Network (Nexus KAN)*

³*Young Earth System Scientists (YESS) Community*

⁴*University of Cape Town, South Africa*

1- Introduction and background

Majority of the countries in sub-Sahara Africa missed most of the Millennium Development Goals. Nevertheless, its successor, the Sustainable Development Goals (SDGs) are even more ambitious: reaching zero poverty and hunger with significant improvements in health, wellbeing and the environment by 2030 (UN General Assembly, 2015). In just eleven years from today, Africa has the steepest mountain to climb. Is it even possible? This is a very simple question for a complex response.

This webinar explored the opportunities and challenges related to connecting technology innovation to sustainable development; analyzing the leverage points to unlock opportunities for integrated impactful solutions; and demonstrating leadership in sustainable development through sustainability science. The webinar, presented by **Dr Cheikh Mbow**, highlighted opportunities and challenges related to: connecting technology innovation to sustainable development; analyzing leverage points to unlock opportunities for integrated impactful solutions; and demonstrating leadership in sustainable development through sustainability science.

2- Challenges of sustainability science for Africa's development

The African context is very challenging. In fact, 25 of the 31 countries which are classified as low-income economies, with a gross national income of US \$ 1,025 or less, are in Africa (The World Bank, 2017). The eleven countries with the highest proportion of residents living in extreme poverty are in Africa (World Data Lab, 2019) and despite only emitting an estimated two to three percent of carbon dioxide (UNFCCC, 2006) the continent is predicted to bear the brunt of climate change and related extreme events (Schellnhuber, *et al.*, 2013). Finally, the unemployment rate in Africa is about 7.9 percent for the whole continent while reaching up to 46.1 percent in Congo, 34 percent in Namibia, 26.7 percent in South Africa and 26.4 percent in Swaziland (Trading Economics, 2018). Achieving the SDGs within the next 11 years seems very ambitious. Applying the SDGs in Africa needs reform in the ongoing decision-making system and urgent measures to

consider at different levels. However, many challenges are slowing this transformation and the implementation of the sustainable development goals.

The different challenge levels are presented as follows: *the bottom-up approach* where the chances of success and failure of the SDGs are highly linked to the engagement of the community. However, the SDGs are negotiated globally, at high level discussions where the community is not involved. On the other hand, *the non-clear approach and pathway for the transformation* where the African context is complicated as it presents a big diversity and interests, many differences among the countries within the continent and significant issues of non-equity. Thus, there is a need to define a clear approach and pathways through which each country within Africa can address the SDGs while considering the complex socio- economic environment over the continent.

3- Ways towards sustainable transformation of Africa

The ways towards the transformation for a “sustainable Africa” were discussed and the discussion engaged to identify some key solution that can foster sustainable development in the continent and made the following observations: Firstly, in order to achieve the transformation, it is crucial to demonstrate leadership and innovation in sustainable development through sustainable science. Investment in research and development is required. Thereby, it has to be ensured that these are designed in accordance to the continent’s needs by connecting social and scientific practices; that is, moving research from “impact factor” to “impact actor” and ensuring that it serves the needs of the local community and society. Secondly, possibilities to create actions in order to achieve transformation and to spur SDGs in Africa, which remains very challenging, were explored. There is a need for an innovative bottom-up approach based on the actual problem in Africa in order to successfully achieve the SDGs. Nevertheless, without good governance, strong institutions, available funding to promote research, SDGs elements alone are not enough to create the continent’s transformation. There should be the implementation of “*missing SDGs*” as mentioned and that include “*governance, structures, institutions, and funding*”.

4- The role of early career scientists in sustainability science

According to the UN-DESA (2017) report, by 2030 the number of youths aged under 24 years old would be by about 42 percent. This young generation could be that positive and driving force for the continent’s development when provided with the proper knowledge and opportunities they need to prosper.

Young Africans such as the YESS community and PAUWES CoP should make efforts to identify what exactly the continent needs, create information on what the locals need through fundamental research, then make innovation that are useful, based on this information. Transformation can only start from the local level.

5- Conclusion

This webinar explored the opportunities and challenges related to sustainable development; analyzing the leverage points to unlock opportunities for integrated impactful solutions; and demonstrating leadership in sustainable development through sustainability science. Additionally, the importance of creating actions in order to achieve transformation and the spur SDGs in Africa, which remain very challenging were explored. It was noted that an innovative bottom-up approach was needed based on the actual problem in Africa in order to successfully achieve the SDGs. Nevertheless, investment in science, research and development, in accordance to the continent needs, is required and should be connected to social needs. The scientific practices should change from “impact factor” to “impact actor” to serve the community. In overall, it was concluded that the SDGs elements alone are not enough to create the continent's transformation, but there should also be the implementation of “missing SDGs” such as governance, structures, institutions, and funding.

Webinar speaker:

Dr Cheikh Mbow is the Executive Director of START - International in Washington; Adjunct Professor at Michigan State University-Forestry and Coordinating Lead Author in IPCC. He has been a Senior Scientist at the World Agroforestry Centre (ICRAF) and served in Scientific Committees such as the Global Land Project (2004-2010); IGBP from 2012-2014 and Future Earth (2013-2015). Dr Mbow works on research and capacity building on land resource management in developing countries.

References

- Schellnhuber, H.J.; Hare, B.; Serdeczny, O.; Schaeffer, M.; Adams, S.; Baarsch, F.; Schwan, S.; Coumou, D.; Robinson, A.; Vieweg, M.; Piontek, F.; Donner, R.; Runge, J.; Rehfeld, K.; Rogelj, J.; Perette, M.; Menon, A.; Schleussner, C.F.; Bondeau, A.; Svirejeva-Hopkins, A.; Schewe, J.; Frieler, K.; Warszawski, L.; Rocha, M. (2013). Turn Down the Heat: Climate Extremes, Regional Impacts, and the Case for Resilience, 254 pp. Washington, D.C: World Bank. URL: <https://www.gov.uk/dfid-research-outputs/turn-down-the-heat-climate-extremes-regional-impacts-and-the-case-for-resilience>
- The World Bank. (2019). World Development Indicators - Classifying countries by income. URL: <https://datatopics.worldbank.org/world-development-indicators/stories/the-classification-of-countries-by-income.html> (accessed 20.11.2019).
- Trading Economics. (2018). Unemployment Rate: Country List - Africa. URL: <https://tradingeconomics.com/country-list/unemployment-rate?continent=africa> (accessed 20.11.2019).

UN General Assembly. (2015). Transforming our world: the 2030 Agenda for Sustainable Development, *A/RES/70/1*. Washington, DC: United Nations. URL:

<https://sustainabledevelopment.un.org/post2015/transformingourworld>

United Nations Department of Economic and Social Affairs (UN-DESA). (2017). World Population Prospects: The 2017 Revision. New York: United Nations. URL:

<https://www.un.org/development/desa/publications/world-population-prospects-the-2017-revision.html> (accessed 06.11.2019).

United Nations Framework Convention on Climate Change (UNFCCC). (2006). National Inventory Submissions 2006. Bonn: UNFCCC. URL:

http://unfccc.int/national_reports/annex_i_ghg_inventories/inventory_review_reports/items/3724.php (accessed 20.11.2019).

World Data Lab. (2019). World Poverty Clock. URL: <https://worldpoverty.io> (accessed 06.11.2019).

The Digital Explosive Technology in the 4th Industrial Revolution in Africa

Author: Rondrotiana Barimalala^{1,2} and Faten Attig Bahar^{2,3,4}

Affiliations:

¹*University of Cape Town, South Africa*

²*Young Earth System Scientists (YESS) Community*

³*Chair of Wind Energy Technology, Faculty of Mechanical Engineering and Marine Technology, The University of Rostock. Germany*

⁴*Future Earth Water-Energy-Food-Nexus Knowledge-Action Network (Nexus KAN)*

1- Introduction and background

The digital revolution started back in the 1940s when the first working transistor was invented. Since then, the digital world has seen an explosive rise and is currently available to almost everyone. In fact, the technology has advanced more in the last 30 years than in the previous 2000 years, and the exponential increase of the digital technology still continues. This has led to the questioning of how Africa is coping with such a revolution and whether it is actually benefiting the continent or it has been a threat to it. In this proceeding, Professor **Mammo Muchie** shared his ideas on the digital world in the African context by exploring the threats and opportunities for solving economic, environmental, social and political problems.

2- Importance of digital revolution for Africa

Today, aiming for sustainable development cannot go alone without the use of technology. Africa needs to engage on the marathon race of the digitalizing world in order to achieve the United Nations' Sustainable Development Goals (SDGs) (UN General Assembly, 2015) as well as the African Union Agenda 2063 (African Union Commission, 2013). Engaging would mean, not only being intelligent users but also as developers of the technology that works on African lands. It is time for Africa to perform, transform, change and reform. For instance, due to modern technology, it was possible to organize this webinar series on Sustainable Development in Africa with such outstanding speakers.

Whether it is appreciated or not, the digital world is already spreading in different forms over Africa and affecting our economy, environment, social and political lives (Kouton, 2019; Myovella, *et al.*, 2019; Schurman, 2018; Van Rensburg, *et al.*, 2019). There is no other choice than embracing it, otherwise the race will be lost. However, no one really knows who controls it. In such cases, the intelligent use of these technologies is important in order to avoid "illicit flow" of information. Technology is moving fast, and way faster than what human institutions can control. It is an important asset for sustainable development but has to be managed intelligently. There is

therefore a need for active engagement to promote the public oversight of fast-moving technology in order to create opportunities not dangers.

3- How technology can be used as a development tool in Africa

Fully embracing the digital world would have to start at a government level. Many countries in Africa are yet to digitize their basic systems such as storage and verification of identities, ownership records and banking. An intelligent use of digitalization would help to enhance transparency and reduce fraudulence and corruption which often are identified as the main issues for the development of the continent.

The economy of most African countries is highly dependent on agriculture. Transforming traditional agriculture into “smart agriculture” would benefit not only the farmers but also lead to resolving the continent’s food security. Such smart agriculture requires on time access to weather information, soil monitoring, automated irrigation, etc.

One of the major issues in Africa is access to electricity despite the continent having ample resources to produce green energy (e.g. solar power from the Sahara). Efforts are therefore needed to exploit these resources in order to provide access to affordable energy for Africans.

In the past few years, Africa has observed a “mobile device miracle”. Today’s access to the internet has increased by more than 20 percent compared to 2017 (ITU, 2019). In 2016, these devices generated about USD 110 billion in economic value of Africa. Mobile devices are therefore expected to contribute about 7.7 percent of the GDP of the continent and create 3.5 million jobs (GSMA, 2018).

Moreover, Africa is becoming home to many tech-startups that should be fully to bigger projects. Many African scientists are also already diving in the fields of machine learning, robotics, biotechnology, among others. The application of these knowledge in the continent will bring development in different areas such as health-care, education, transportation, etc. (Kaplan and Haenlein, 2016; King, *et al.*, 2018).

It is to be noted, however, that the adoption of the digital world in the continent does not imply removing what is traditional. In fact, it can be used to promote African indigenous knowledge, wisdom, spirituality, philosophy, history and culture. In such a way, the use of technology can lead to not only economic and environmental solutions but also used for social entrepreneurship and innovation (Elia, *et al.*, 2019).

4- The role of early career scientists in technology development in Africa

Africa has many talented early career scientists (ECS), both living in Africa and abroad. There is a lot to be explored and developed in the continent. These ECS are the generation to lead the use

and development of technology in Africa. It cannot wait any longer if we really want to engage in the digital world marathon race. It is time for them to act, later would be too late.

5- Conclusion

The digital revolution is moving very fast, and we are to embrace it or lose it. Now is the right time for Africa to dive into the digital world by using it intelligently and by developing what is really needed in the continent. The African ECS are the generation to bring the transformation but there is a high responsibility from everyone, including those in authorities and each citizen for sustainable development to happen.

Webinar speaker

Professor Mammo Muchie founded the *African Journal on Science, Technology, Innovation and Development (AJSTID)* in 2008 and serves as its editor-in-chief, ever since. He has been given best institutional senior researcher of the year merit and academic excellence award. Prof. Muchie took up the mammoth task of producing an impressive body of research on innovation systems (in whatever rudimentary forms or degrees of evolutionary state they exist) in various African countries. He taught over 400 doctoral candidates in doctoral academies across the world in the Globelics, Africalics, Cicalics, Indialics networks. He has taken major initiatives for running Doctoral and Masters Academy in various universities in Africa and all over the world. One such academy is recently organized by the Association of Commonwealth Universities. Also, he has been invited for many keynote addresses and lectures in Africa and world-wide. He is the Founder of the Africa Post-Graduate Academy that has been training masters and doctoral students drawn from different disciplinary backgrounds applying the unity of knowledge approach to upgrade quality supervision. He has published over 400 papers, book chapters, articles and given over 100 keynotes.

References

- African Union Commission. (2013). *Agenda 2063: The Africa We Want*. Addis Ababa: African Union. URL: <https://au.int/en/agenda2063> (accessed 06.11.19).
- Elia, G., Margherita, A., Passiante, G., (2019). Digital Entrepreneurship Ecosystem: How Digital Technologies and Collective Intelligence are Reshaping the Entrepreneurial Process. *Technological Forecasting and Social Change*. Vol. 150, 119791. URL: <https://doi.org/10.1016/j.techfore.2019.119791>
- GSMA. (2018). *The Mobile Economy: Sub-Saharan Africa 2018*. *GSMA Intelligence*. URL: <https://www.gsma.com/mobileeconomy/sub-saharan-africa/> (21.11.2019)

- ITU. (2019). Statistics: Individuals Using the Internet, 2005-2019. *Committed to Connecting the World*. Sustainable Development Goals. URL: <https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx> (accessed 13.11.2019).
- Kaplan, A. M., Haenlein, M. (2016). Higher Education and the Digital Revolution: About MOOCs, SPOCs, Social Media, and the Cookie Monster. *Business Horizons*. Vol. 59 (4): 441–450. URL: <https://doi.org/10.1016/j.bushor.2016.03.008>
- King, B., Fishman, E.K., Horton, K.M., Rowe, S.P. (2018). The Incipient Digital Revolution in Hospitality and Health Care: Digital Is Hospitable. *Journal of American College of Radiology*. Vol. 15 (9): 1351–1353. URL: <https://doi.org/10.1016/j.jacr.2018.05.013>
- Kouton, J. (2019). Information Communication Technology Development and Energy Demand in African Countries. *Journal of Energy*. Vol. 189, 116192. URL: <https://doi.org/10.1016/j.energy.2019.116192>
- Myovella, G., Karacuka, M., Haucap, J. (2019). Digitalization and Economic Growth: A Comparative Analysis of Sub-Saharan Africa and OECD economies. *Telecommunications Policy*. 101856. URL: <https://doi.org/10.1016/j.telpol.2019.101856>
- Schurman, R. (2018). Micro(soft) Managing a ‘Green Revolution’ for Africa: The New Donor Culture and International Agricultural Development. *Journal of World Development*. Vol. 112: 180–192. URL: <https://doi.org/10.1016/j.worlddev.2018.08.003>
- UN General Assembly. (2015). Transforming our world: the 2030 Agenda for Sustainable Development, *A/RES/70/1*. United Nations. URL: <https://sustainabledevelopment.un.org/post2015/transformingourworld> (accessed 06.11.2019).
- Van Rensburg, N.J., Telukdarie, A., Dhamija, P. (2019). Society 4.0 Applied in Africa: Advancing the social impact of technology. *Journal of Technology in Society*. Vol. 59: 101125. <https://doi.org/10.1016/j.techsoc.2019.04.001>

Ways Toward Sustainable Development in Africa: Review of the Webinar Series Discussions

Author: Faten Attig Bahar^{1,2,3}

Affiliations:

¹*Chair of Wind Energy Technology, Faculty of Mechanical Engineering and Marine Technology, The University of Rostock, Germany*

²*Young Earth System Scientist (YESS) Community*

³*Future Earth Water-Energy-Food-Nexus Knowledge-Action Network (Nexus KAN)*

1- Introduction and background

For this webinar series, the challenges and opportunities for sustainable development in Africa were discussed while stressing the role of the social engagement and the role of science in shaping the future of the continent. This discussion had a particular focus on food, water, energy availability, challenges of air pollution, the needed science for the continent transformation toward sustainability and the ways that can Africa effectively engage with the digital revolution. The webinars and all discussions were free and open to the public. In addition to its originality, this project showed particular example of how to reduce carbon footprint and enables interaction across regions and cultures through a fully online event.

This paper summarizes the main debates held during the event while responding to the questions: How to achieve sustainable development in Africa and what are the mechanism allowing the transformation in the continent?

2- Mitigation and Blueprints

For sustainable development in Africa, there are high-level development framework documents that underpin Africa's future development. The two key concepts/documents established in this case are: The African Union Commission (2013) adopted the Agenda 2063 on "The Africa we want" with 20 goals that is the strategic framework for the socio-economic transformation of Africa over the next 50 years. The other document is by the UN General Assembly (2015) that adopted the "2030 Agenda for sustainable development with 17 SDGs" as the universal call to action to end poverty, protect the planet and ensure that all people can enjoy peace and prosperity.

There is very good alignment between the African Union's Agenda 2063 and the UN's SDGs. Both will promote sustainable development in Africa: The 17 UN SDGs fit into the 20 goals of the Agenda 2063. The agenda 2063 is broader in scope, covering social, economic and environmental considerations in the broad context, political cultural and other African priorities. Therefore, by implementing the agenda 2063 African Union member states will ipso facto be meeting global obligations under the SDGs (Table 1).

Table 1: Agenda 2063 Goals and Priority Areas and Links to the SDGs

| Agenda 2063 Goals & Priority Areas and Links to the SDGs | SDG |
|---|---------------|
| 1. A high standard of living, quality of life and well-being for all citizens | SDG 1 |
| • Incomes, jobs and decent work | SDG 2 |
| • Poverty, inequality and hunger | SDG 8 |
| • Social security and protection | SDG 11 |
| • Modern, affordable and livable habitats | |
| 2. Well-educated citizens and skills revolution underpinned by science, technology and innovation | SDG 4 |
| • Education and science, technology and innovation-driven skill revolution | |
| 3. Healthy and well-nourished citizens | SDG 3 |
| 4. Transformed economies | SDG 8 |
| • Sustainable and inclusive growth | |
| • STI-driven manufacturing | |
| 5. Modern agriculture for increase productivity | SDG 2 |
| 6. Blue ocean economy for accelerated economic growth | SDG 14 |
| • Marine resources and energy | |
| • Port operations and marine transport | |
| 7. Environmentally sustainable and climate-resilient economies and communities | SDG 15 |
| • Bio-diversity, conservation and sustainable natural resource management | SDG 13 |
| • Water security | SDG 6 |
| • Climate resilience and natural disaster preparedness | SDG 7 |
| 8. A united Africa | |
| • Frameworks and institutions for a united Africa | |
| 9. Continental financial and monetary institutions established and functional | |
| 10. World-class Infrastructure crisscrosses Africa | SDG 9 |
| • Communications and infrastructure connectivity | |
| 11. Democratic values, practices, universal principles of human rights, justice and the rule of law entrenched | SDG 16 |
| • Democracy and good governance | |
| • Human rights, justice and the rule of law | |
| 12. Capable institutions and transformative leadership in place | SDG 16 |
| • Institutions and leadership | |
| • Participatory development and local governance | |
| 13. Peace, security and stability are preserved | SDG 16 |
| 14. A stable and peaceful Africa | |
| • Institutional structure for AU instruments on peace and security | |

| | |
|--|--------------------------------|
| • Defense, security and peace | |
| 15. A fully functional and operational APSA | |
| 16. African cultural renaissance is pre-eminent | |
| • Values and ideas of pan-Africanism • Cultural values and African renaissance • Cultural heritage, creative arts and business | |
| 17. Transformed economies | SDG 5 |
| • Empowerment of women and girls • Violence and discrimination against women and girls | |
| 18. Engaged and empowered youth and children | SDG 4 SDG 5 |
| 19. Africa as a major partner in global affairs and peaceful coexistence | SDG 17 |
| 20. Africa takes full responsibility for financing her development goals | SDG 10 SDG 17 |
| • African capital markets • Fiscal system and public sector revenue | |

3- Air quality for Africa

One of the main factors responsible for the large mortality rate in Africa is surprisingly not diseases, mal-nutrition or bad water quality but poor air quality (OECD, 2016). In particular, fine particles with a diameter of less than 2.5 micrometers (PM_{2.5}) are responsible for an estimated 22 percent of infant deaths in sub-Saharan Africa (Heft-Neal, *et al.*, 2018). Likewise, the well-being of many animals and plants depends on the air quality. In many African regions (such as the Sub-Saharan Africa), the poor air quality leads to serious impacts on human health (SDG3) and causes the death of many children. To effectively protect their health, information availability including access to warnings of high pollution episodes is crucial. City dwellers face many environmental challenges due to mainly to air pollution and weather, climate and water-related hazards, and are therefore particularly affected.

When speaking about shaping the future of the African continent, it is indispensable to tackle air pollution as one of the main factors responsible for the large mortality rate in Africa. Air quality is related to several sustainable development goals (SDGs).

4- The needed science for Africa

Society expects science to highly contribute and provide solutions to local issues guided by global agendas like SDGs and AU 2063. The science needed for Africa should be structured in a way to fully benefit the needs of the society, engage with the community and connect social and scientific practices. Investing in science, research and development, in accordance to the continent needs, is required and should be connected to social needs. Therefore, an innovative bottom-up approach

based on the actual local problems is crucial in order to ensure the effective sustainable transformation and achieve the SDGs in the continent.

The scientific practices should change from “impact factor” to “impact actor” to serve the community. In the African context, the SDGs elements alone are not enough to create the continent's transformation, but there should also be other important factors like the good governance, engaged institutions and available funding to finance innovative research that may have an impact on the society.

5- Effective use of the digital revolution

Today, aiming for sustainable development cannot go alone without the use of technology. Africa needs to engage on the marathon race of the digitalizing world in order to achieve the United Nations' Sustainable Development Goals (SDGs) as well as the African Union Agenda 2063. Engaging would mean, not only being intelligent users but also as developers of the technology that works on African lands. It is time for Africa to perform, transform, change and reform.

The digital world is already spreading in different forms over Africa and affecting our economy, environment, social and political lives (Kouton, 2019; Myovella, *et al.*, 2019; Schurman, 2018; Van Rensburg, *et al.*, 2019).

Fully embracing the digital world would have to start at a government level. Many countries in Africa are yet to digitize their basic systems such as storage and verification of identities, ownership records and banking. An intelligent use of digitalization would help to enhance transparency and reduce fraudulence and corruption which often are identified as the main issues for the development of the continent.

The economy of most African countries is highly dependent on agriculture. Transforming traditional agriculture into “smart agriculture” would benefit not only the farmers but also lead to the continent's food security. Such smart agriculture implies on time access to weather information, soil monitoring, automated irrigation, etc.

One of the major issues in Africa is access to electricity despite the continent having ample resources to produce green energy (e.g. solar power from the Sahara). Efforts are therefore needed to exploit these resources in order to provide access to affordable energy for Africans.

6- African youths to foster sustainable development in the continent

In a previous United Nations report, it was indicated that about 60 percent of Africa's population are youth under the age of 24 and by 2030, there are predictions that the number of youth would increase by about 42 percent (UN-DESA, 2017).

The new generation of scientists should be very alert on the solutions for the local issues and this young generation could be that positive and driven force for continent development when provided with the knowledge and opportunities they need to prosper. In particular, the early career scientists and professionals involved in PhD and master programs in different fields of fundamental and applied science can apply their knowledge in their countries for a sustainable development and contribute in a productive economy.

7-Conclusion

The first edition of the YESS-PAUWES webinar series was a success as it achieved its intended goals and objectives. Vital lessons on sustainable development in Africa and how science and social engagement could be used in shaping the continent's future were learnt.

Africa has many talented early career scientists (ECS), both living in Africa and abroad. There is a lot to be explored and developed in the continent. These ECS are the generation to lead the sustainable development in Africa at its different levels.

References

- African Union Commission. (2013). *Agenda 2063: The Africa We Want*. Addis Ababa: African Union. URL: <https://au.int/en/agenda2063> (accessed 06.11.19).
- Elia, G., Margherita, A., Passiante, G., (2019). Digital Entrepreneurship Ecosystem: How Digital Technologies and Collective Intelligence are Reshaping the Entrepreneurial Process. *Technological Forecasting and Social Change*. Vol. 150, 119791. URL: <https://doi.org/10.1016/j.techfore.2019.119791>
- Heft-Neal, S., J. Burney, E. Bendavid, M. Burke. (2018). Robust Relationship between Air Quality and Infant Mortality in Africa. *Nature*. Vol. 559(7713): 254-258. <https://doi.org/10.1038/s41586-018-0263-3>
- Kouton, J. (2019). Information Communication Technology Development and Energy Demand in African Countries. *Journal of Energy*. Vol. 189, 116192. URL: <https://doi.org/10.1016/j.energy.2019.116192>
- Myovella, G., Karacuka, M., Haucap, J. (2019). Digitalization and Economic Growth: A Comparative Analysis of Sub-Saharan Africa and OECD economies. *Telecommunications Policy*. 101856. URL: <https://doi.org/10.1016/j.telpol.2019.101856>
- OECD. (2016). The Cost of Air Pollution in Africa. *OECD Development Centre Working Paper No. 333*. Paris: OECD Publishing. URL: <https://doi.org/10.1787/5jlqzq77x6f8-en>

- Schurman, R. (2018). Micro(soft) Managing a ‘Green Revolution’ for Africa: The New Donor Culture and International Agricultural Development. *Journal of World Development*. Vol. 112: 180–192. URL: <https://doi.org/10.1016/j.worlddev.2018.08.003>
- UN General Assembly. (2015). Transforming our world: the 2030 Agenda for Sustainable Development, *A/RES/70/1*. United Nations. URL: <https://sustainabledevelopment.un.org/post2015/transformingourworld> (accessed 06.11.2019).
- United Nations Department of Economic and Social Affairs (UN-DESA). (2017). World Population Prospects: The 2017 Revision. New York: United Nations. URL: <https://www.un.org/development/desa/publications/world-population-prospects-the-2017-revision.html> (accessed 06.11.2019).
- Van Rensburg, N.J., Telukdarie, A., Dhamija, P. (2019). Society 4.0 Applied in Africa: Advancing the social impact of technology. *Journal of Technology in Society*. Vol. 59: 101125. <https://doi.org/10.1016/j.techsoc.2019.04.001>