

# Impacts of COVID-19 on Sustainable Development in Africa

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## Abstract

The COVID-19 pandemic affected all countries in the world, including high-income countries in Europe and North America, and low-income countries in Africa and South America. It led to the partial closure of most economic and social activities. The pandemic created disruptions that led to significant economic loss. In 2020, huge amounts, unbudgeted expenses, were invested globally as epidemic control expenses. The spending was targeted at returning normalcy to the world as quick as possible. This paper reviews the sustainable development goals and presents implications in the context of the coronavirus pandemic. The evidence emanating from the review informed the recommendation that the sustainable development goals shape and inform recovery plans from COVID-19. It emphasizes that lingering issues around climate change induced by anthropogenic activities such as greenhouse gas emission and deforestation place a demand on countries to bring the solutions to issues addressing biodiversity crises and income inequalities. The paper concludes that the coronavirus pandemic demonstrates that countries will only be able to protect themselves from global pandemics if health systems are strengthened through adequate funding.

**Keywords:** Sustainable development, covid-19, health systems, Africa

## **Introduction**

The world recently faced one of the public health crises in health history, with ripple effects on the socio-economic and the environment globally (Prah 2020, Ortega & Orsini 2020 Honey-Rosés, *et al.*, 2020). Coronavirus disease (COVID-19) is a highly contagious pathogenic viral infection, which emerged in Wuhan in China (Rothan *et al.*, 2020, Qin *et al.*, 2020). With a rapid global spread that and bewildered experts and scientists, the World Health Organisation (WHO) pronounced the coronavirus (COVID-19) outbreak as a global pandemic on March 11, 2020 (WHO 2019).

The COVID-19 pandemic affected all countries in the world, including high-income countries in Europe and North America, and low-income countries in Africa and South America. It led to the partial closure of most economic and social activities. As a consequence, industries and facilities with a large workforce were locked (Sheridan *et al.*, 2020). The aviation and hospitality industries experienced inaction in a bid to curtail the spread of the disease through human contact. Also, villages/towns/counties/cities/provinces were isolated as a response to COVID 19 pandemic. In 2020, huge amounts, unbudgeted expenses, were invested globally in epidemic control and policy responses (Nyarko, 2020; Olayide, 2020). The purpose of the investment was to return normalcy to the world.

This paper examines sustainability in Africa in the face of COVID-19 within the African context because of its richness and the lessons that could be drawn to better position the continent to accomplish the seventeen Sustainable Development Goals by 2030 using a reflective/perspective approach. Despite the threat associated with the covid-19 pandemic, the continent with its youth population who are highly creative at this critical time need debates on how to maximise the opportunities associated with the challenges. History has continually repeated itself to show that development rarely takes place without the effective use of critical junctures, that is, critical world events (Acemoglu and Robinson, 2012).

## **COVID-19 and African Countries Experiences**

African countries, despite an existing weak health infrastructure system also took commendable actions and waged effective to combat the spread of coronavirus in the continent. Some of the most affected countries

including Algeria, Cameroon, Côte d'Ivoire, Ethiopia, Ghana, Kenya, Madagascar, Nigeria, Senegal and South Africa have recorded infections drop over time compared to other developed countries (WHO, 2021). Mortality attributed to COVID-19 has also remained low in the region. We attribute the low number of cases in Africa to the following factors.

### *Young population*

The African population is dominantly young which can be linked to playing a critical role in reducing the transmission of the disease. Contrary to what has been recorded globally, where a vast majority of those who have died have been aged over 80 as of December 2020. Africa is home to the world's youngest population with a median age of 19 years (UNDP, 2020). A meagre 3% of Africa's population is aged over sixty-five years which is a wide construct compared to Europe, North America and some Asian countries (He *et al.*, 2015). This data is lower than the rest of the world, however, projected to increase to 42% by 2030 and more than double from current levels by 2055 (Lutz *et al.*, 2018).

### *Favourable climate*

Recent research carried out by a group of researchers at the University of Maryland in the US shows a relationship between temperature, humidity and latitude, and how COVID-19 is transmitted. According to Demongeot (2020), the virulence of coronavirus disease causative organism reduces in humid and hot weather.

### *Low level of testing*

African countries have had low levels of testing with only ten countries accounting for 80% of the coronavirus testing taking place across Africa (WHO, 2020; Renzaho, 2020). As a result, a handful of African countries were responsible for the bulk of tests that were carried out. Low testing implies that more people that were infected and recovered from the disease were not captured. Hence, there is a high likelihood that infection in Africa would have been higher if testing was on a large scale.

### **Post COVID-19: Forging a Sustainable Future**

As the world prepares to enter a post-COVID-19 era, the need to make the recovery plan sustainable, it will be important to put the United Nations

Sustainable Development Goals at the heart of policymaking and recovery plans from COVID-19 (Sachs, 2020). Lingering issues around climate change induced by anthropogenic activities such as greenhouse gas emission, deforestation and others such as melting glaciers place a demand on countries to bring the solution to issues addressing biodiversity crises.

A synopsis of the covid-19 on sustainability as linked up in the three dimensions of sustainable development can be seen in Table 1. This shows the corresponding effects of COVID-19 and recommendations for the actualisation of the global goals across the social, economic and environmental dimensions of sustainability. The impact of COVID-19 on social sustainability include increase poverty aggravated by economic lockdown and job losses, hunger due to fall in incomes and reduced food availability during the lockdown, higher food loss and waste due to transportation challenges and reduced labour availability, higher disease incidence and mortality from COVID-19 and other causes as a result of the overstressed health system predicated by COVID-19, temporary closure of the school and academic activities affecting human capital development, precarious energy prices globally, movement restriction as a result of relaxed means of public transports.

In contrast, these challenges bear with them opportunities for global goals. These include the creation of effective social protection programmes, restructuring, redistributing the national and global economy, strengthening food production processes to attain food security, women's empowerment, reliable energy, and alleviation of related health problems through adequate and accessible health insurance.

Furthermore, effects of the pandemic on the economic dimension include job loss leading to mass unemployment, business bankruptcies and economic meltdown, disruption of local and international trade, the decline in industrial outputs due to partial & temporary reduction in industrial production leading to a reduction in profit and folding up of small scale industries, decline in industrial pollution, loss of jobs of a lower-skilled, short-term reduction in natural resource use due to reduced economic activity and consumption, increased plastic pollution (e.g., used to produce personal protective equipment. These impacts can be addressed by sustaining the reduction in industrial pollution as a response to climate change, strengthening equality and empower engendered groups and institutions, adopting measures that support a fair transition for workers

affected by the digital and technological revolution, providing economic stimulus to inject necessary funds to support ailing economy's recovery process, adoption of clean energy technology to reduce Green House Gases (GHGs) emission, supporting the development of digital services and e-commerce, FINTECH, Artificial Intelligence (AI) and Internet of Things (IoT) for reduced physical transactions and travel time.

**Table 1: Effects of COVID-19 and recommendations on SDGs**

The dimension of Sustainable Development	Linked SDGs	Effects of COVID-19	Recommendation
Poverty		<ul style="list-style-type: none"> <li>Increased poverty aggravated by economic lockdown and job losses</li> <li>Increases in relative and absolute poverty will push more people into extreme poverty</li> </ul>	<ul style="list-style-type: none"> <li>Provide effective social protection programmes</li> <li>Provide adequate palliatives for SMEs, vulnerable groups and internally displaced persons.</li> <li>Insurance products for the poor</li> <li>Provide loan relief and suspend debt servicing for affected organizations and poor countries momentarily</li> <li>Restructure and redistribute the economy nationally and globally.</li> </ul>
Hunger		<ul style="list-style-type: none"> <li>Reduction in global food supplies and trade resulted in food insecurity and hunger</li> <li>Lower-income households are disproportionately experiencing effects of food insecurity, trade-offs between efficiency and resilience.</li> </ul>	<ul style="list-style-type: none"> <li>Strengthen food production processes to attain food security</li> <li>Provide/strengthen local and international trade for agricultural commodities</li> <li>Strengthen farmers' resilience against climate change and food systems sustainability through climate-smart and technology-driven agriculture.</li> </ul>
Social	Health and Wellbeing	<ul style="list-style-type: none"> <li>Higher disease incidence and mortality from COVID-19 and other causes as a result of the overstressed health system predicated by COVID-19.</li> <li>Overloaded hospital systems</li> <li>Increase in mental health cases on mental health (e.g., anxiety and depression) and domestic injuries as a result of the lockdown</li> <li>The stigmatisation of persons affected and recovered from COVID 19 may lower self-esteem. Also, lack of disclosure of COVID 19 health status owing to perceived stigmatisation may lead to community spread of the virus</li> </ul>	<ul style="list-style-type: none"> <li>Strengthen the role of public health and disease prevention and surveillance systems and support medical personnel to curtail communicable and chronic diseases.</li> <li>Provide adequate funding and budget allocation in line with WHO recommendations for improved medical services, increase resilience and response rate to shocks/crises</li> <li>Accelerate efforts to achieve universal health care</li> <li>Support digital health solutions (e.g., telehealth) to reduce the burden on hospitals and increase access to care</li> <li>Improved public awareness of COVID-19</li> </ul>
	Quality Education	<ul style="list-style-type: none"> <li>Temporary closure of School and academic activities affecting human capital development</li> <li>In some countries, disruption of school feeding programmes led to poor nutrition and increased hunger among school children</li> <li>Suspension of ongoing research activities</li> </ul>	<ul style="list-style-type: none"> <li>Further investments in STEM education, digital skills, equity, and lifelong learning</li> <li>Develop and make digital educational tools affordable and easily accessible</li> <li>The blended school where appropriate</li> </ul>
	Gender Equality	<ul style="list-style-type: none"> <li>Increase cases of domestic violence and abuse</li> <li>Increase in Mortality rates for gender-specific comorbidities</li> </ul>	<ul style="list-style-type: none"> <li>Prioritise women's needs</li> <li>Provide and strengthen existing public services and social protection policies that promote shared responsibility within the household and the family</li> <li>Enforce national legislation for the promotion of gender equality at all levels of the government</li> <li>The economic stimulus that could lessen the financial burdens of households and individuals to reduce the rate of financial-induced gender violence</li> </ul>
	Affordable Energy	<ul style="list-style-type: none"> <li>Reduction in economic growth leading to precarious energy prices globally</li> </ul>	<ul style="list-style-type: none"> <li>Countries should become more energy-efficient and invest in clean energy infrastructure</li> <li>Strengthen international actions to promote access to clean energy, development.</li> </ul>
	Sustainable Cities and Communities	<ul style="list-style-type: none"> <li>Increase in urban poverty and exposure to high vulnerability.</li> <li>The massive use of single-use medical protections (tests/masks, etc.</li> <li>Relaxed public transports mean as a result of movement restriction.</li> </ul>	<ul style="list-style-type: none"> <li>Strengthen scientific and technological capacity in cities to adopt sustainable patterns of consumption and production.</li> <li>Strengthen public access to safe, inclusive and accessible, green and public spaces.</li> <li>Develop integrated and sustainable means to address the impact of travel restrictions on business, exports, and tourism etc</li> </ul>

	<ul style="list-style-type: none"> <li>• Ineffective waste management and recycle stations closing down</li> <li>• reduction in GHGs emissions</li> </ul>	<ul style="list-style-type: none"> <li>• Sustained reduction in GHGs emission with the adoption of clean energy technology</li> <li>• Adoption of Smart city and work from home that is supported by digital platforms</li> </ul>
Peace Justice and Strong Institutions	<ul style="list-style-type: none"> <li>• Increased pressure on political leaders and governments to alleviate the economic impacts of the pandemic</li> <li>• The pressure to build and strengthen existing medical infrastructure to accommodate the rising number of cases</li> <li>• A shift in government priorities project implementation</li> <li>• Human rights violations</li> </ul>	<ul style="list-style-type: none"> <li>• Reduce all forms of violence, conflict and insecurity</li> <li>• Protection of human rights and entrenchment/initialisation of structure to protect human rights</li> </ul>
Decent work and Economic growth	<ul style="list-style-type: none"> <li>• Economic crisis</li> <li>• Disruption in local and international trade</li> <li>• Loss of job increasing the unemployment level</li> <li>• Business bankruptcies and economic meltdown</li> </ul>	<ul style="list-style-type: none"> <li>• Support the development of digital services and e-commerce, fintech for less physical contact during transactions</li> <li>• Develop sustainable and structured territorial strategies to address the impact of travel restrictions on local and international trade and business, tourism, sports etc.</li> <li>• Provide economic stimulus to inject necessary funds to support the ailing economy's recovery process. This may also include a welfare package for the unemployed.</li> </ul>
Economic	<p>Industry Innovation and Infrastructure</p> <ul style="list-style-type: none"> <li>• Decline in industrial outputs due to partial &amp; temporary reduction in industrial production leading to a reduction in profit and folding up of small-scale industries</li> <li>• Hastened adoption of digital technologies, for business, education, health etc</li> <li>• Remote working</li> <li>• Reduced noise and environmental pollution</li> <li>• The decline in industrial pollution.</li> </ul>	<ul style="list-style-type: none"> <li>• Accelerate the adoption of measures that support a fair transition for workers affected by the digital and technological revolution</li> <li>• Sustained the reduction in industrial pollution as a response to climate change</li> </ul>
	<p>Reduced inequality</p> <ul style="list-style-type: none"> <li>• Increased economic impacts on the vulnerable population</li> <li>• Loss of jobs of lower-skilled, lower-wage labour economic shocks from COVID-19 will likely exacerbate inequalities in all countries.</li> </ul>	<ul style="list-style-type: none"> <li>• Strengthen equality and empower engendered groups and institutions</li> <li>• Provide strong social safety nets for lower-income brackets</li> </ul>
	<p>Responsible Consumption and production</p> <ul style="list-style-type: none"> <li>• Reduction in natural resource use due to reduced economic activity and consumption</li> <li>• Increase in plastic pollution, especially personal protective equipment</li> </ul>	<ul style="list-style-type: none"> <li>• Provide sensitisation awareness for sustainable production and lifestyles</li> <li>• Integration of circular economy into production and consumption processes</li> </ul>
	<p>Good water and Sanitation</p> <ul style="list-style-type: none"> <li>• Limited access to clean water among disadvantaged groups limits the possibility of adhering to strict hygiene guidelines</li> <li>• Adherence to hand washing under running water may negatively impact water-stressed communities.</li> </ul>	<ul style="list-style-type: none"> <li>• Accelerate efforts to provide universal access to water and sanitation and increase focus on hygiene and hand washing to help curb transmission of oral-faecal diseases</li> </ul>
Environment	<p>Climate Action</p> <ul style="list-style-type: none"> <li>• Drastic reduction in greenhouse gas emissions</li> <li>• Lack of focus on climate action</li> </ul>	<ul style="list-style-type: none"> <li>• Focus on the implementation of the Paris Climate Agreement that sets a vision for long-term change</li> <li>• Provide incentives for green/renewable energy sources</li> <li>• Promote systems that promote effective climate change-related mitigation and adaptation.</li> </ul>
	<p>Life below water</p> <ul style="list-style-type: none"> <li>• Reduced threats to marine biodiversity due to reduced global economic activity and consumption</li> <li>• The pressure to reduce marine biodiversity and ecosystem safeguards</li> <li>• Reduction in plastic pollutant owing to restriction on movement, especially for tourist-based and tourist endowed coastline communities</li> </ul>	<ul style="list-style-type: none"> <li>• Ensure that marine pollution is significantly reduced as lockdown become eased</li> </ul>
	<p>Life on land</p> <ul style="list-style-type: none"> <li>• Reduction in threats to terrestrial and freshwater lives and biodiversity due to reduced economic activity and consumption</li> </ul>	<ul style="list-style-type: none"> <li>• Pursue efforts to reduce negative impacts on biodiversity and ecosystems to prevent future pandemics</li> </ul>

Source: Sachs *et al.*, 2020

The environmental impacts of COVID-19 short-term reduction in global GHG emissions, reduction in economic growth contributing to dangling energy prices, short-term reduction in threats to marine biodiversity due to reduced global economic activity and consumption, reduction in plastic pollutants owing to restriction on movement, especially for tourist-based and tourist endowed coastline communities, short-term reduction in threats to terrestrial and freshwater biodiversity due to reduced global economic activity and consumption. These challenges can be leveraged upon by concerted efforts to reduce negative impacts on biodiversity and ecosystems to prevent future pandemics, protecting ocean pollution, raising capacity for effective climate change-related planning and management among others.

### **Conclusion and Recommendations**

Africa has had to deal with the staggering impacts of COVID-19, which hinders the drive for sustainable development and affecting various aspects of the world's economy including food system and agriculture, health and wellbeing, housing, transportation, infrastructure, communication and other regular day to day activities. Therefore, to actualise the global goals despite the effects of the pandemic would require setting new development priorities along with sustainability issues.

While advocating for inclusive and sustainable development, the challenges induced by the pandemic must be well evaluated and be effectively examined. The emergence and the drive to get over the global menace of COVID-19 has intrinsic resources to drive sustainable development. Therefore, achieving sustainability would require adequate policy planning and prioritising the global goals. Countries would need to be more deliberate, strategic and come up with measurable approaches for evaluating growth.

As Africa prepares to enter a post-COVID-19 era, the need to make the recovery plan sustainability into the process becomes imperative in the face of a changing climate. This can be achieved by developing integrated and sustainable means to address the impact of the pandemic and forge a sustainable future for the continent. This is important as the world moves towards a green economy. The pandemic provides the leadership of the African countries ample opportunities to rethink their developmental strategies to ensure that the continent maximises all available opportunities

to consolidate on existing gains in ensuring that the content is safe for the current and future generations, with unlimited opportunities for migrants. Africa Union 2060 agenda is a good start, if and only if, the development plan is supported with decisive steps.

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### References

- Acemoglu, D. and J.A. Robinson (2012). *Why nations fail: The origins of power, prosperity, and poverty*. (1st). 1st ed. New York: Crown, 529.
- African Countries by population (2020). [https:// www.worldometers.info /population/countries-in-africa-by-population/](https://www.worldometers.info/population/countries-in-africa-by-population/) Accessed on 21st September 2020.
- Alagona, P., J. Carruthers, H. Chen, M. Dagenais, S. Dutra e Silva, G. Fitzgerald and M. Armiero (2020). Reflections: Environmental History in the Era of COVID-19. *Environmental History*, 25(4), 595-686.
- Demongeot, J., Y. Flet-Berliac and H. Seligmann (2020). Temperature decreases the spread parameters of the new Covid-19 case dynamics. *Biology*, 9(5), 94.
- Falzetti, M., W. Keiper, A. Igartua, R. Martins, N. Gonzalez and E. Le Bourhis (2020, September). The role of Materials in post-COVID society. In Research and Innovation days, 22-24/9/2020.
- Gostin, L.O. and L.F. Wiley (2020). Governmental public health powers during the COVID-19 pandemic: stay-at-home orders, business closures, and travel restrictions. *Jama*, 323(21), pp.2137-2138.
- He, W., D. Goodkind and P.R. Kowal (2016). *An aging world: 2015*.
- Honey-Rosés, J., I. Anguelovski, V.K. Chireh, C. Daher, C. Konijnendijk van den Bosch, J.S. Litt and M.J. Nieuwenhuijsen (2020). The impact of COVID-19 on public space: an early review of the emerging questions—design, perceptions and inequities. *Cities & Health*, 1-17. <https://www.worldometers.info/coronavirus/coronavirus-age-sex-demographics/>.



- International Monetary Fund (IMF), (2020). Policy Responses to COVID-19. Accessed via <https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19>.
- Lau, L.J.Y. and Y. Xiong (2020). The COVID-19 Epidemic in China. World Scientific.
- Lieder, M. and A. Rashid (2016). Towards circular economy implementation: a comprehensive review in the context of the manufacturing industry. *Journal of cleaner production*, 115, 36-51.
- Ludvigsson, J.F. (2020). A systematic review of COVID-19 in children shows milder cases and a better prognosis than adults. *Acta paediatrica*, 109(6), 1088-1095.
- Lutz, W., A. Goujon, S. Kc, M. Stonawski and N. Stilianakis (2018). Demographic and human capital scenarios for the 21st century: 2018 assessment for 201 countries. Publications Office of the European Union. (Lutz et al., 2017).
- Murray, A., K. Skene and K. Haynes (2017). The circular economy: an interdisciplinary exploration of the concept and application in a global context. *Journal of business ethics*, 140(3), 369-380.
- Nagifallma, P., M.S. Hossain and K. Andersson (2020). A Deep Transfer Learning Approach to Diagnose Covid-19 using X-ray Images. In 2020 IEEE International Women in Engineering (WIE) Conference on Electrical and Computer Engineering (WIECON-ECE) (pp. 1-6).
- Nyarko, R. O., E. Boateng, I. Kahwa, P.O. Boateng and B. Asare (2020). The Impact on Public Health and Economy Using Lockdown as a Tool against COVID-19 Pandemic in Africa: A Perspective. *J Epidemiol Public Health Rev*, 5(3).
- Olayide, O.E. (2020). Policy Milleu for Combating COVID-19 and Sustainability of African Economies. In Carmody et al (Eds). *COVID-19 in the Global South: Impacts and Responses*. Bristol University Press. P 75-84.
- Ortega, F. and M. Orsini (2020). Governing COVID-19 without government in Brazil: Ignorance, neoliberal authoritarianism, and the collapse of public health leadership. *Global public health*, 15(9), 1257-1277.
- PrahRuger, J. (2020). Positive public health ethics: toward flourishing and resilient communities and individuals. *The American Journal of Bioethics*, 20(7), 44-54.
- Qin, C., L. Zhou, Z. Hu, S. Zhang, S. Yang, Y. Tao, and D.S. Tian (2020). Dysregulation of the immune response in patients with coronavirus 2019 (COVID-19) in Wuhan, China. *Clinical infectious diseases*, 71(15), 762-768.

- Renzaho, A. (2020). The need for the right socio-economic and cultural fit in the COVID-19 response in Sub-Saharan Africa: examining demographic, economic, political, health, and socio-cultural differentials in COVID-19 morbidity and mortality. *International journal of environmental research and public health*, 17(10), 3445.
- Rothan, H.A. and S.N. Byrareddy (2020). The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak. *Journal of autoimmunity*, 109, 102433.
- Sachs, J., G. Schmidt-Traub, C. Kroll, G. Lafortune, G. Fuller and F. Woelm (2020). *The Sustainable Development Goals and COVID-19. Sustainable Development Report 2020*. Cambridge: Cambridge University Press.
- Sheridan, A., A. L. Andersen, E.T. Hansen and N. Johannesen (2020). Social distancing laws cause only small losses of economic activity during the COVID-19 pandemic in Scandinavia. *Proceedings of the National Academy of Sciences*, 117(34), 20468-20473.
- UNDP, (2020). Africa's Defining Challenge [https://www.africa.undp.org/content/rba/en/home/blog/2017/8/7/africa\\_defining\\_challenge.html](https://www.africa.undp.org/content/rba/en/home/blog/2017/8/7/africa_defining_challenge.html). Accessed on 19th September 2020.
- UNDP, (2020) Africa's defining challenge [https://www.africa.undp.org/content/rba/en/home/blog/2017/8/7/africa\\_defining\\_challenge.html](https://www.africa.undp.org/content/rba/en/home/blog/2017/8/7/africa_defining_challenge.html) Accessed on 19th September 2020.
- WHO, (2021). World Health Organisation (WHO) Coronavirus Disease (COVID-19) Dashboard <https://covid19.who.int/> Accessed on February 24, 2021.
- WHO, (2019). [https://www.who.int/emergencies/diseases/novelcoronavirus2019?gclid=CjwKCAjwrKr8BRB\\_EiwA7eFapsUeJVzqIDjfKYc2GA08-aB7\\_0ff4krShTT5EmUU1Gexq6fRFdQKpxoC4HgQAvD\\_BwE](https://www.who.int/emergencies/diseases/novelcoronavirus2019?gclid=CjwKCAjwrKr8BRB_EiwA7eFapsUeJVzqIDjfKYc2GA08-aB7_0ff4krShTT5EmUU1Gexq6fRFdQKpxoC4HgQAvD_BwE).
- Yeşilbağ, K. and G. Aytoğu (2020). Coronavirus host divergence and novel coronavirus (Sars-CoV-2) outbreak. *Clinical and Experimental Ocular Trauma and Infection*, 2(1), 6-14.