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RESEARCH ARTICLE

Articulating the effect of pesticides use and sustainable development goals (SDGs): The science of improving lives through decision impacts

***Morufu Olalekan Raimi*[1]*, *Tonye Vivien Odubo*[2], *Ogah Alima*[3], *Henry Akpojubaro Efegbere*[4], *Abinotami Williams Ebuete*[2]**

[1] *Department of Community Medicine, Environmental Health Unit, Faculty of Clinical Sciences, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria*

[2] *Department of Geography and Environmental Management, Niger Delta University, Nigeria*

[3] *School of Health and Life Sciences, Teesside University, Middlesbrough, United Kingdom*

[4] *Department of Community Medicine, Edo University, Iyamho, Edo State, Nigeria*

***CORRESPONDENCE:** Morufu Olalekan Raimi; daorentuya@apacsci.com

ABSTRACT

Nothing vast comes into a mortal's life without a curse. Identifying the pathways of pesticide impact can be multifaceted as well as complex, as humankind faces the magnificent challenge of food systems reconfiguration toward providing and delivering healthy foods that individual can access while protecting planetary health. Ideally, chemical pesticides used inappropriately in agricultural activities have shaped serious health as well as environmental problems in the global south. The United Nations Environment Program (UNEP) as well as World Health Organization (WHO) approximate that the rates of pesticide poisoning occur 2-3 times per minute, having roughly 20,000 employees dying yearly from exposure, mostly in emerging countries. From an environmental point of view, "chemically-polluted runoff" comes through fields that pollute both the ground and surface waters, destroying freshwater ecosystems, damaged fisheries, as well as creating growing and sustainable "dead zones" in the coastal areas near the river's mouths of the drain agricultural areas. The environmental as well as health hazards resulting from pesticides could remain comparatively avoided through education as the first step towards achieving the SDGs as well as creating sustainable incentives toward curbing the overuse trend. Other important challenges need to be resolved, for example social inclusion; poverty reduction; education, increased equity as well as health care; sustainable energy; conservation of biodiversity; water security; and changing climate adaptation as well as mitigation. These challenges are interlinked as well as embodied in 2030 Agenda for Sustainable Development, which all UN member states have accepted since 2015 as well as built round the 17 Sustainable Development Goals (SDGs). Therefore, managing the rapid accelerators considerately will need negotiation as well as collaboration from a wide range of civil society sector, private as well as public actors. The time has come toward putting the challenge of sociotechnical innovation as well as massive human ingenuity toward usage to safeguard the next generations as well as the planet future. While, the world is not on the pathway toward realizing its global goals come 2030. Prior to the outbreak of COVID-19, uneven

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progress had been witnessed, as well as more focused considerations was required in many areas. The sudden onset of the pandemic abruptly hampered the SDGs implementation and, in other cases, twisted decades of progress backwards.

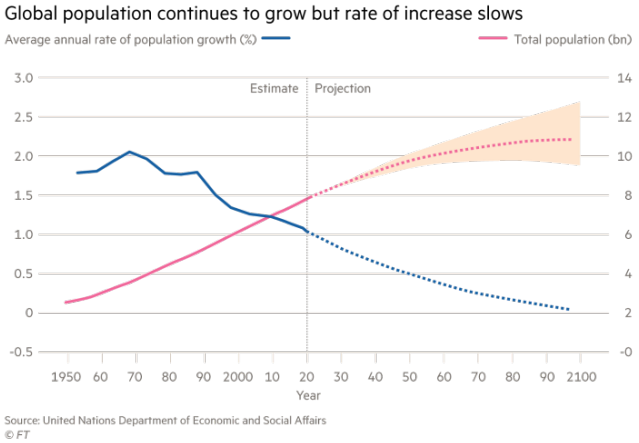
***Keywords**: human ingenuity; decision impacts; sustainable development goals; planetary health; pesticides; dialogue and cooperation; outreach programs; Nigeria*

1. Introduction

2020 marks the decade of action for the sustainable development goals. It was an important opportunity to accelerate efforts to address the world's major challenges by spreading shared vision and ending poverty as well as hunger caused by climate change (Raimi et al., 2018; Olalekan et al., 2020; Morufu et al., 2021). The outbreak of the novel coronavirus has caused unprecedented disruption to the global consumer supply chain market, resulting in global crude oil prices fall, global commodity and financial market turmoil, the disappearance of sporting events and recreational activities, the suspension of numerous individual activities in various countries, and intercontinental travel restrictions on important global routes, along with triggering the biggest recession in 90 years and stunted hard-won progress (Gift & Olalekan, 2020; Gift et al, 2020; Samson et al., 2020; Raimi et al., 2020; Raimi & Raimi, 2020; Morufu et al, 2021). The goal of sustainable development may not be achieved unless we mobilize and equitably allocate resources to respond to large and persistent crises. As these consequences, driven by decreasing global demand, have had big impact on household livelihoods and business activity, consumer confidence and production have slowed simultaneously.

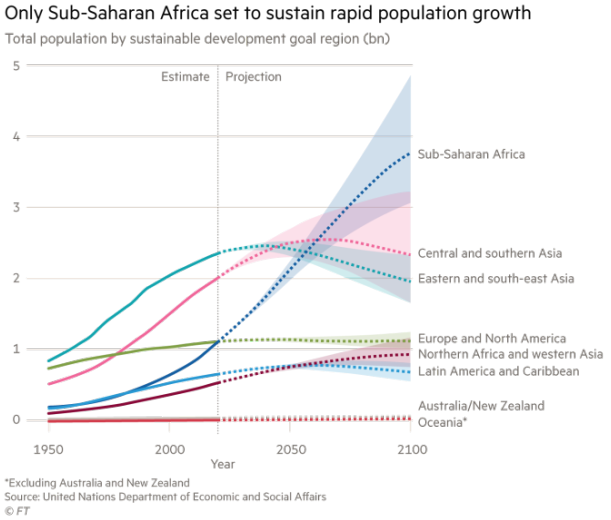
World events in 2020 took place in exceptional circumstances—we don't have much good news–and they are necessary to adopt exceptional approaches, policies and decisions between government domains and private along with non-profit sectors. These incidents are still gradually focused on supply chains and networks beyond the reach of governance, discipline and jurisdiction. Globally, agricultural growth over the next decade is expected to ensure rising demand for food and intensify land competition. By 2030, as population growth decreases and crops continue to improve, agricultural land will still increase. Deforestation is currently being reduced, as is the additional demand for agricultural land, and these activities are expected to continue, particularly from 2030 (Raimi et al., 2019; Olalekan et al, 2019; Raimi et al, 2019; Isah et al, 2020; Raimi et al., 2020; Morufu, 2021). Differential development of population between regions and countries will be significant. The world's population is expected to increase from 2.2 billion to about 9.2 billion by 2050. Much of this development will take place in the Middle East, South Asia and, in particular, Africa (see **Figures 1** and **2** below). Similarly, the population of sub-Saharan Africa is expected to increase a billion in the next 30 years and continue to overtake Central and South Asia to become the world's most populous region. High fertility rates in sub-Saharan Africa mean that Africa will account for more than half of the world's population growth between now and 2050, according to projections from the United Nations Population Division. As the number of people living in and outside Asia declines, the populations of the regions will continue to grow until the end of the century. This trend is mirrors of the situation in Nigeria, where the population has soared from 95 million in 1990 to 210 million by 2020 (Olalekan et al., 2018; Olalekan et al., 2019; Olalekan et al., 2020). Nigeria's population is expected to double to 400 million by 2050, when it will overtake the United States as the world's third most populous country. Niger, where women have about seven children on average, has the highest birth rate in the world,

Figure 1. Global population continues to grow but rate of increase slows..



Source: United Nations Department of Economic and Social Affairs

Figure 2. Only Sub-Saharan Africa set to sustain rapid population growth.



Source: United Nations Department of Economic and Social Affairs.

and the population is expected to nearly triple to 66 million over the same period. By 2050, Niger is expected to be the only country in the world with a fertility rate higher than four children per woman in her lifetime.

2. Pesticide use, population and sustainable development

All regions' demographics are ageing, especially in China, Italy and OECD countries. People are becoming more and more urbanized. By 2050, more than 2.8 billion people are expected to live in cities, accounting for about 70 percent of the world's population. Over the same period, the rural population is expected to shrink by 600 million. This rapid urban distribution is expected to spread disproportionately across the globe. By 2050, 86% of the population in OECD countries is expected to live in cities. In the southern hemisphere, one of the smallest urban areas, the proportion of urban residents was nearly 37% in 2010, but some are expected to reach 60% by 2050. Cities with a population of less than 500,000 will grow faster than other urban centers. As megacities continue to grow at a geometric rate (UNHabitat, 2006; United Nations, 2018), and this will continue to be a dynamic change observed in recent years. Rapid urbanization growth and industrialization have greatly promoted the spread and use of pesticides, especially in emerging countries, which have both advantages and disadvantages, although population concentration can make the production and use of pesticides possible. However, pesticide exposure levels are often more likely to increase and may worsen environmental conditions in slums, with serious consequences for human health (Morufu et al., 2021; Morufu, 2021; Isah et al., 2020; Olalekan et al., 2020; Isah et al., 2020; Olalekan et al., 2020; Adedoyin et al., 2020; Olalekan et al., 2020; Sawyerr et al., 2018; Adeolu et al., 2018). Although population dynamics are key driving factors for local and global environmental change, population growth leads to increased consumption of natural resources and land use, resulting in additional environmental pressures. Changes in wealth and age structure will also alter lifestyles, consumption habits and diets, which may have a negative impact on the environment. The world's population has risen from less than 4 billion in 1970 to 7 billion so far. By 2050, the United Nations estimates the

world's population will be around 9.2 billion which is a 2.2 billion population increase (see Figure 1 and 2).

According to these population projections, global pesticide use will increase and remain largely stable by 2050, although dietary differences are likely to continue to be a key factor in the growth of agricultural demand and production. The year 2015 marked a major breakthrough on the path to sustainable development. According to the Millennium Development Plan, a new cycle of sustainable development goals (SDGs) aims to guide governments and the international community in their commitment to a sustainable world, especially as human activities continue to push the planet beyond its borders, the necessity to achieve the SDGs is more urgent than ever. More than 800 million people are still starving and world food production is expected to increase by 50% by 2050 to meet the projected global demand of more than 9 billion people (Food and Agriculture Organization of the UN, 2018). The environmental, economic and social problems of our world affect all of us, from how we eat to, how we work, how we communicate and how we learn. It is firmly believed that education is the first step towards achieving the sustainable development goals. Collective learning and aware-raising through outreach, to improve and promote understanding of the science and policies behind sustainable development and to empower policy makers, researchers, practitioners and citizens to make informed decisions on how to support greater sustainability by providing courses that cover all SDGs, including themes such as health, development, climate change, agriculture, human rights and sustainable investment (Raimi et al., 2018; Raimi et al., 2019; Omidiji & Raimi, 2019; Suleiman et al., 2019; Olalekan et al., 2019; Olalekan et al., 2020; Adedoyin et al., 2020; Olalekan et al., 2020; Raimi et al., 2020; Morufu et al., 2021). For several years, farmers in Nigeria have been plagued by inchworms that have had to rely on pesticides to kill them, because this pest is the only real impediment to productivity and health. Although it was misinterpreted as a sign of vulnerability at a time of danger from bubbles and economic strangulation, there is no denying that pesticide concerns have become a problem, and this is because of direct human action. Adoption of these methods can significantly reduce the exposure problems faced by farmers. The most important pesticide issues are the side effects of long-term chronic exposure, such as genetic stability that changes hormone balance, suppression of the immune system, and the carcinogenic ability of certain pesticides, such as cypermethrin (Raimi et al., 2020), to cause cancer in humans due to toxic effects from exposure. Hospital morbidity data showed that more than 70% of rural residents who come to hospitals for health care suffer from typhoid fever, malaria and other food and water borne diseases, which local authorities may still have the authority to address, prevent and accelerate action to fast track rural development, agricultural support and job creation (Raimi et al., 2017; Olalekan et al., 2018; Raimi et al., 2019; Raimi et al., 2019; Olalekan et al., 2019; Gift & Olalekan, 2020; Olalekan et al., 2020; Gift et al., 2020). In addition, pesticide use by Nigerian farmers has been identified as a major obstacle to the elimination of food contamination, which often leads to severe morbidity and loss of life. The Federal Ministry of Science and Technology reported in the middle of the year that more than 200,000 Nigerians die each year from foodborne diseases and poisonings caused by pollution before, during and after planting. However, the success of the Millennium Development Goals (MDGs), while relatively distant from the ambitious goals set at the beginning of the millennium, has prompted the world to adopt a new set of goals, based on a set of activities, known as the Sustainable Development Goals (SDGs), which aims to end hunger and poverty

Figure 3. Source: Adapted from https://www.un.org/sustainabledevel- opment/development-agenda/.

by 2030. Same as the Millennium Development Goals, the SDGs were designed from the ground up, and by working together on pre-agreed tasks, the world is in a better position to meet the aspirations of citizens, including farmers' aspirations for prosperity, peace and progress. However, the SDGs remain a collection of 17 global goals and 169 specific goals for 2030, as set by the UN General Assembly in 2015 (see **Figure 3**).

The Sustainable Development Goals (SDGs) are the 70/1 resolution of UN General Assembly, part of the 2030 Agenda. To achieve zero poverty and zero hunger is part of the goal of sustainable development. Agricultural development is an important component of the achievement of a large number of Sustainable Development Goals and is a sound and most effective strategy to eradicate poverty (Goal 1), eradicate hunger (Goal 2), safeguard health and well-being (Goal 3), promote industrial growth (Goal 9), reduce inequality (Goal 10), and so on. The main goal of the Sustainable Development Goals is to improve and promote the health and well-being of farmers of all ages. It is clear, by some accidental coincidence, which the role of the farmer profession, which is still the traditional production of food, has evolved in scope over the years, tending to rely harmoniously on the additional complex synthesis of the Sustainable Development Goals. The use of pesticides in agricultural practices illustrates the importance of the Sustainable Development Goals for individuals and their health and general well-being, including responsible production and consumption. It recognizes that pesticides are essentially toxic and have the potential to cause incalculable harm and disruption to farmers, including threats to their lives and incomes, and that failure to carefully choose the most affordable or cost-effective decisions can cause inconvenience to farmers and even increase poverty. Above all, the government must play an important mediator role for farmers in the fight against pesticides. Importantly, this is consist with the Sustainable Development Goals, which emphasizes partnerships and collective collaboration, and sustained efforts to reduce food contamination through collective learning and education for farmers. Policies that benefit the private sector are also needed to improve the agricultural practices of smallholder farmers, thereby improving relationships along the supply chain, increasing their production and marketing of healthy food, and improving the health of rural communities through the consumption of safe products. Governments

need to work with the private sector to support and help stimulate industry innovation, promote sustainable organic food systems, and produce better, safer food while protecting biodiversity and natural resources. In addition, authorized participants should be encouraged to make room for competition and cooperation in pesticide use policies. Correct decision making and correct results is the key to sustainable development. Growth must be driven by agricultural priorities, which are important factors in promoting development, as well as the rapid adoption of new technologies to boost the sector and to reshape and improve the agricultural and food systems to better feed Nigerians and achieve sustainable development. It needs to be guided by our commitment, that is providing high quality agricultural food systems, used it as an important tool for achieving a more peaceful, prosperous and sustainable future. In addition, "ecological and social policies" aims to transform behaviour or provide incentives for additional and advanced sustainable environmental management or resource use, while strengthening adaptability and resilience of communities and individuals to achieve social goals.

3. The road ahead

In fact, everyone must work together to achieve the 2030 Agenda for Sustainable Development and the Sustainable Development Goals. Different sectors and actors need to work together in a coordinated manner through combining of resources, knowledge and expertise. Innovation and sectoral multi-stakeholder collaboration are therefore needed as important steps towards achieving the goals we need to achieve by 2030. More than ever, government-led activities should continue to be supported by partnerships in order to achieve sustainable development. The rich knowledge and experience that these companies and their partners possess is critical to effectively supporting the implementation of the Sustainable Development Goals. The 2030 Agenda for Sustainable Development will call for greater collaboration among all organizations, all countries and all individuals so that we can effectively implement and achieve the commitment of 17 interrelated sustainable development goals. Opportunities and challenges lie on the road to achieve all 17 Sustainable Development Goals and create a better future for us all. This is a problem faced by all individuals and nations. However, the problem can be overcome through real-time collaborative partnerships.Designing targeted key and outreach programmes, these programmes can accurately address pesticide risks, safe handling and pre-emptive behaviour, which are key features that we all want to promote the health of the planet and people. At the same time, investment in the SDGs reduces risk exposure and vulnerability and is a major driver of resilience. While pesticide risks must be understood, managed, and ultimately mitigated by all actors, governments must take the lead in adopting a risk-informed perspective. Governments are the risk-takers of last resort. When a crisis occurs, private risk often becomes public responsibility. Policymakers therefore need to mainstream risk considerations into all policies, processes and decisions.

Going forward, there is a need to invest in sustainable, resilient and equitable recovery of safe pesticide use. Instead of trying to restore the economy of the past, governments must invest in measures to protect their citizens from pesticide risk, poverty (projections suggest that by 2020, the epidemic could push 71 million people back into extreme poverty, the first rise in poverty worldwide since 1998. Some of them are employees in the informal economy, whose incomes fell by as much as 60 percent in the first calendar month of the disaster. Half of the world's approximately 1.6 billion employees support themselves and their families through uncertain and often unsafe jobs in the informal economy, and are significantly affected by them), hunger

and existential threats, while sharing the fruits of globalization more equally. These investments may require new forms of financing, including long-term instruments spanning 40 to 50 years. However, investment alone is not enough. To address the systemic nature of global pesticide risks, it is necessary to reform agricultural institutions and policy structures, strengthen multilateralism, and create new platforms and networks for global cooperation. These ideas will inform and continue to inform discussions by the United Nations, the Government and other partners in 2021. All Governments and other stakeholders are urged to meet the expectations of the citizens they serve through unified, united and coordinated multilateral action. It stressed that policy action must be taken to ensure effective support until the recovery can proceed in a robust manner.

Competing interests

We declare that we have no conflict of interest that could be deemed to impair the impartiality of the reported research. This research was not specifically funded by any funding agency in the public, commercial or non-profit sector.

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