

SCIENCE AND SOCIETY: AFRICA'S PERSPECTIVE

Shem O. Wandiga and Eric O. Odada

Kenya National Academy of Sciences, Nairobi, Kenya

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Summary

Uplifting food production to the level of self-sufficiency in Africa remains a major challenge for science in the next century. It calls for leveling of high population growth, economic development of rural areas through relevant education in science, improvement of human health and environment and sustainable use of natural resources. Achievement in these areas will result in changed consumption pattern and reduced waste generation that may be scientifically managed. Science and scientific knowledge application hold the key for Africa's socioeconomic improvement. Mobilization of resources should put women, youth and the elderly as priority groups. International co-operation and assistance directed to disadvantaged societies in ways that improve their socioeconomic status holds promise.

1. Introduction

African society derives its roots in its customs and cultural perception of nature, supernatural powers and humanity. Many African cultures use the environment to support life. Multiple cures were and are still found from plants, animal parts, water and

the living organisms within, like fish, and water plants. Traditionally, destruction of environment or life is prohibited in many customs and cultural laws. The soil has been, for decades, left alone to yield plants that are used for food. Modern large plantation agriculture was introduced by the 'white settlers.' Through them, modern cash crops like maize, wheat, barley, tea, coffee, cocoa and rubber plants were introduced.

African science evolved from the use of plants and animals for the cure of diseases. In many herbal prescriptions, plants roots, barks, and leaves were boiled and the extract drunk or chewed, and leeches swallowed or mixed with other animal parts to expel evil spirits. There are evidences that surgery or bone fracture treatment were practiced by some societies in Africa long before the advent of modern medicine. Africans lived with animals and culled them for food. Taming of animals evolved with time. Some tamed animals were imported by foreign settlers and quickly adopted by pastoralists.

Modern western science was introduced to Africa by the missionaries and colonial governments. Some of the first African degree holders in chemistry, mathematics, physics or biology are still alive. Similarly, some of the first African medical doctors to graduate from medical school are still living. Modern African science adopted the British, French, Belgian or German syllabus and system. The missionaries looked down on African traditional science as primitive and/or inferior. Great efforts were made to modernize the African to the extent that most traditional African science has been abandoned by the present society. Indeed, many modern Africans look down on African herbal medicine and would prefer to swallow western drugs at any cost.

Through colonization, the African society has been transformed into a western society aping either the British, French or American (due to their global cultural influence) societies. The present African lives a dual personality, one indigenous and the other western. Neither shall the two be reconciled. The dual cultural heritage of the African creates development agenda and issues that may be unique to Africa. From a cultural tradition that used resources fully aware of their limits evolved a self-centered person who accumulates wealth and glorify riches; a person who destroys the environment and all living things in it. The self-serving African of today would delight in destroying the source of livelihood for others, as long as individual gains are maximized. This is the African that we need to transform back to the original roots in the twenty-first century.

Present public images of Africa is that of a continent with emaciated children, uncontrolled population growth, chronically suffering from food scarcity, has a plethora of diseases, and with abundant tribal conflicts. Children are taught to learn that bad leaders, who practice misrule and plunder of resources, are found mainly in Africa. Political coups repeat themselves year in year out. Above all, poverty is widespread in the continent. Poverty according to *Webster's Seventh New College Dictionary* is defined as "lack of money or material possessions; want; scarcity, dearth; debility due to malnutrition; lack of fertility". Accordingly, the World Summit for Social Development and Beyond has focused the attention of the world community to Africa, as one of the priority continents for socioeconomic developmental assistance. Today, almost half of Africa's population is living in absolute poverty, with about 30% classified as extremely poor (living on less than US\$ 1/day). Africa is noted for its falling per capita income during the last 20 years. For example, in 1980 the GNP per capita was US\$ 770, in 1998

it dropped to US\$ 480. The challenge of poverty reduction is dependent on broad-based and sustained economic growth, complemented by the more efficient provision of social services such as education, health care, improved standards of nutrition, and access to clean water and sanitation.

On the other hand, sustainability implies the use, preservation and conservation of nature, with its life-support systems, including human, natural resources, physical and biological environment and all activities that help keep them beautiful, clean and healthy. Development emphasizes improvement of people's lives, economy and society. Often, reference is made to economic development, which comprises improvement of productive sectors for increased employment and desired consumption and wealth. Therefore, no matter whether one is desirous of reducing poverty or improving sustainable development, one cannot achieve much without the use of scientific knowledge.

The following environmental problems affect all nations but have most impact in Africa: climate change, loss of biological diversity, land degradation and desertification, deforestation and forest degradation, pollution of fresh and marine waters, depletion or increase of stratospheric ozone, and accumulation of persistent organic pollutants. The manifestation of these problems except for the last two are observed through droughts or floods, permanent disappearance of animal and plant species, soil erosions, enlarging desert areas, declining tropical forest areas (only about 2 million square kilometers of frontier and non-frontier forests remain), and uncontrolled growth of macrophytes in fresh water lakes, as well as non-useable river waters and polluted coastal areas.

Given these concerns, it is essential that any national policy on development that does not take into consideration an integrated approach to environmental issues will fall short of its goals. Sustainable development can only be achieved through incorporating environmental issues into all sectoral decisions, including management of agriculture, land resources, forestry, energy, and water resources. Concerted efforts should be made to correct market, policy, institutional, and knowledge failures. Both management and administrative mechanisms, 'command and control' policies, market mechanisms, and voluntary agreements should be used in various combinations to effect improvement.

Exploring the use of scientific knowledge in Africa for poverty eradication, sustainable development forms the basis of this paper.

2. Missed Opportunities

The twentieth century has been a lost period for Africa. During this period, the continent evolved from being colonies to full independent states. It has now taken approximately three to four decades of self-rule for most African countries, since the end of colonization. During the period of full independence rule, the Cold War divided the political allegiance of most of the countries into Eastern or Western spheres. With the collapse of the Union of Soviet Socialist Republic, many African nations found their support for economic and political authority changed. Old regimes had to quickly abandon their ways and adopt democratic principles. The end result of the Cold War and the democratization process taking place have seen the emergence of internal conflicts,

the deterioration of infrastructure, economic stagnation and increased prevalence of poverty for most of the population.

Nature has not spared Africa and the Africans either. Global climate change has brought disasters associated with unpredictable weather. Old diseases like yellow fever, dysentery, typhoid, and malaria have re-emerged with a vengeance. New diseases, like ebola, human immuno-deficiency virus/acquired immuno-deficiency syndrome (HIV/AIDS) have become pandemic. Concurrent with these changes has come the burden of financial debt repayment. Repayment of squandered debts has stifled any meaningful economic growth. As a result, educational institutions, health services, social services and infrastructure have collapsed or have been left to decay for lack of financial resources.

At the beginning of the twenty-first century, democratic systems have taken root in most African nations. Liberalization of the economy has brought competitiveness in trade. All current forces such as population, gross domestic product (GDP) per capita, world gross domestic product, food, energy, water carbon dioxide, except hunger, show trend scenarios of increases ranging from 1.5 to 4.5 times the 1995 level.

Africa is unfortunate that food production lags behind population growth, with population levels projected to reach 1454 million in 2025 and 2.050 million in 2050. On the other hand, Africa is possibly the only continent that may realize a faster growing economy in this century. An economic growth scenario of up to 4% is projected during the coming century. Despite these projections, it will take at least a century for developing countries to catch up with the countries belonging to the Organization of Economic Cooperation and Development (OECD). Therefore, given that economic as well as energy growth is primarily to be in developing countries, coupled with debt relief, wealth reallocation by developed countries to developing countries, Africa will most likely see a reversal of its situation. In order for these projections to hold, we discuss here some of the issues that require the attention in order to maximize the possible positive trends.

3. Population and Science

Feeding the fast-increasing population of Africa remains the single most important challenge to science and scientists in the continent. At over 744 million people and growing at an average annual rate of 2.93, stabilization of population growth to a replacement level poses a second challenge to the continent. Some slight decrease in fertility rate (6.6 in 1970–1975 to 6.0 in 1999–1995) has been recorded. However, such a decrease remains small, though significant. UN projections indicate that replacement level will not be reached in Africa until about 2045–2050. In the meantime, feeding over one billion people in the next century, the majority of whom are already born, remains a problem. Despite the earlier indication that life expectancy at birth was improving (46.1 in 1970–1975 to 53.0 in 1990–1995) such gains have been wiped out by epidemic disease like HIV/AIDS, malaria, typhoid and many other enteric water-borne diseases. The crude death rate per 1000 population, although showed signs of improvement (19 in 1970–1975 to 14 in 1990–1995) in the early 1990s, might have

actually reverted to higher numbers in the late 1990s. However, infant mortality rate (95 per 1000 births) is still above the average world rate; 62 in 1990–1995.



Figure 1. Feeding the increasing population, many of whom are already born, is a problem

Stabilization of population depends firstly on provision of quality education especially to the girl- child. Such education includes better knowledge of human body and its function, delayed entry into procreation and use of birth control methods. Some of the proven population stabilization methods include abstinence, the rhythm system, and use of contraceptives and condoms. Science has a contribution to population stabilization. Some of the science challenges include development of male contraceptives, safe and improved female contraceptives, as well as prophylaxis devices. Population has been shown to decline with economic prosperity. Africa's economic growth depends on the use of scientific knowledge.

Africa has seen the highest number of displaced people, both internally and internationally. In the 1990s, there have been many internal wars like the Rwanda tragedy, and those in Burundi, Somalia, Democratic Republic of Congo, Republic of Congo, Sierra Leone and Sudan. These wars and many others have forced thousands of people to immigrate. The total number of internally displaced persons in Africa stood at 1.9 million in 1994 and 1.3 million in 1995. Pastoralist migration has always been a tradition in Africa. Those migrating normally return to their original places at the end of a drought or flood. However, today, permanent migration in search for jobs, escape from economic hardship, wars, political or religious persecution, have become a daily

occurrence. In 1999, there were 21.4 million refugees in all regions of the world out of these Africa had 6.28 million with 1.6 million being displaced persons (Table 1).

	1994	1995	1996
Refugees	6 752 200	5 692 100	3 270 860
Asylum seekers	–	–	63 350
Returnees	3 084 000	2 085 400	1 296 770
Internally displaced persons and others of concern	1 973 100	1 344 000	1 653 700

* UNHCR's funding mandate defines refugees as those who are outside their countries and who cannot or do not want to return because of a well-founded fear of being persecuted for reasons of their race, religion, nationality, political opinion or membership in a particular social group. Displaced persons are people who live in refugee-like situations within their own countries.

Table 1. Persons of concern to UNHCR*

Rural-urban migration is another feature of movement of Africans. In average, urban population is increasing at an average rate of 4%, but may be as high as 7% in some countries. Investment in human capital in Africa is one of the lowest. A large percentage of adult African women are illiterate (54% in 1990) compared to men (30% in 1990). Gross primary school enrollment as a percentage of age group stands at 89 and 105 for female and male in 1990.

Gross enrollment percentage is obtained by dividing of the age group that should be enrolled in school according to the rules of a country. Numbers greater than 100 reflect inaccuracies in the data. However, at tertiary level of education only 5.6% of the cohort age group are enrolled; of those enrolled only 4.3% are women. Statistics for health services are no better and show that as low as 15% of Mali people have access to health facilities while in Mauritius, 100% of its population receive such services. Other countries among the 48 African states have figures between these two countries with only 20 countries having a percentage greater than 50.

Human conflict arises primarily from insecurity, scarcity of resources or economic opportunities and/or human greed. Scientific understanding of the bases of these factors improve tolerance and understanding amongst people. Furthermore, scientific knowledge improves natural resources' exploitation, add value to resources and improve production processes. Wealth creation lies with those who possess knowledge. Increasing the knowledge base in African societies and full utilization of the human resources with that knowledge would enhance socioeconomic development of such societies, stabilize migration and improve educational standards.

4. Combating Poverty

Poverty is a measure of voidness of material wealth. It implies that a person has not accumulated financial savings. It denotes non-possession of land, housing, clothing and most importantly, food, or an inability to buy any of these things. A fair reflection of

how poor we are is also measured by our dependence on charity, social security system or any other organized system for looking after destitute persons. Morally, the poor may be blessed, destitute, indigent, working, deserving or voluntary. The working poor are often referred to as deserving poor. Through the ages the poor have always received sympathy. In the African tradition they were looked after by the well-to-do families. They were never rejected. The continent does not practice a systematic system of discrimination or exclusion based on race or caste system. There were few inherited kingdoms and wherever they were, they did not build walls against sections of their subjects based on tribes. This historical background sets apart the African poor from, for instance, those found in some parts of Asia or the gypsies in Europe. Geo-political considerations associated the poor masses with those exploited and manipulated by the rich, the upper classes. Poverty may also result from structural systems in the society that create unemployment or under-employment in the labour market, exclusion of certain groups within a society or community from capital accumulation or access to fair share of economic benefits. This new form of poverty may be emerging in Africa.

The discussion in this paper confines itself to the first definition.

According to World Bank categorization, there are two poverty groups found in Africa today. The first is the urban poor who are persons born of poor parents and have lived in a city slum all of their lives, or have been attracted to urban centers to look for jobs, but drifted to urban slums for shelter; and the second is the rural poor. The first category of urban slum dwellers have lost their ancestral roots. They neither know their ancestral land nor own one. They have cut social and cultural ties with their tribe, or ethnic group. The 'new' urban poor have ancestral land and strong social and cultural ties with their ethnic group. They may have children and a wife living at ancestral home. All urban poor are willing to work, except that they cannot find a decent well-paying job. They can move out of their poverty situation, provided jobs and decent housing can be provided. A second common factor is that the majority of urban poor are uneducated or have no professional skills.

Provision of education and labor skills is a ladder that enables any of them to climb out of poverty.

A second poverty group forms the majority of persons living in the rural areas. They have land, housing, though of some temporary structure. Some farm, fish or engage in some economic activities. There may be a natural resource of economic potential in their areas but they lack the knowledge for its exploitation. As a general rule, they have no roads, running water, electricity, neighborhood hospitals and other essential amenities. The majority of the rural poor have a low education level.

Poverty in most parts of Africa has not become systematic. Provision of hope, restoration of dignity and teaching of the means to fight poverty can allow reversal of the situation. Therefore, extension of education, teaching of labor skills, provision of roads, electricity and other means of communication, such as telephone, would greatly transform these rural communities. Economic and/or cultural exploitation of the communities is unethical. Fair compensation for labor and products should be observed if the fighting spirit, ability and willingness to work are to be recognized. Science that

helps these communities exploit their natural resources need to form a basis of education curricula.

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Biographical Sketches

Shem Oyoo Wandiga has a Ph.D. in Chemistry from the Case Western Reserve University, US. A professor of Chemistry in the University of Nairobi, Kenya. Professor Wandiga was also Deputy Vice Chancellor (Administration and Finance) of the University. He was subsequently appointed as the Coordinator of the Policy and Planning Task Group of the Ministry of Education (1991), elected as Kenya's Representative to the Executive Board of UNESCO (1995), President of the Program and External Relations Commission of Executive Board (1997), and as a member of the General Committee and Advisory Committee on Environment of the International Council of Science. Currently Chairman of the Kenya National Academy of Sciences, Professor Wandiga is the author of a large number of publications in scientific and educational fields. He has also chaired several national committees on university education and been a consultant on World Bank, UNESCO and United Nations Environment Programme projects undertaken in Kenya and East Africa.

Eric Onyango Odada is an aquatic geochemist focusing on the environmental quality assessment of African lakes and rivers and the study of human impact on these natural systems. He is active in science-driven policy initiatives; currently, leading a consortium of African, European and North American scientists interested in promoting the investigation of African Great Lakes as archives of records of environmental and climatic dynamics in East Africa. He is a Consultant to the Western Indian Ocean States on design and implementation of Integrated Coastal Zone Management; Program Leader of the Global Change regional research and capacity building initiatives in Africa; Coordinator and Chief Scientist in the UN-IAEA Isotope Techniques in Lake Dynamics Investigations in Africa and is Global Environmental Facility (GEF) Strategic Adviser on International Waters. He has over 60 peer-reviewed publications.