Chemistry for Sustainable Development in Africa

Bearbeitet von
Ameenah Gurib-Fakim, Jacobus Nicolaas Eloff

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Preface

The African continent entered the twenty-first century as the world's poorest continent. The economies of most of the countries of the African Union were either growing slowly or declining. This is despite the abundance of natural resources in the continent. Several factors could have been responsible for the poverty and low growth. There have been many studies e.g. by the World Bank on aspects influencing poverty in Africa and how changes in policies and governance can lead to a turn around.

Some encouraging changes have taken place over the past decade. Since 2000, six of the fastest growing countries, were from Africa with Angola being the fastest growing in the world. This change may be ascribed to many aspects. War and political strife was a major factor in causing poverty. In the new century there have been many changes to a more democratic situation. Since then there has also been better economic policies and there was a boom in commodity prices. The per capita income was equally low and falling. Since 2004, there has been dramatic change and the economies of many countries grew on average of 4.6%—the highest rate in the decade. It has been reported that improved macroeconomic management has been the major driver of the recovery. However, looking at GDP alone as a marker for prosperity is misleading as the number of people living in absolute poverty remains higher compared to past decades.

The application of science, technology, and innovation (STI) has led to enormous growth in countries with limited resources. One of the limitations of many countries in Africa is that resources are exported without any beneficiation to create more work and to increase the general quality of life of the people. Yet, it is the most neglected sectors in the development drive of countries even though STI, has an important role to play in the attainment of the continent's sustainable development objectives.

Africa's continued low investment in science and technology is also manifested in the declining quality of science and engineering education at all levels of educational systems. Throughout the 1980s and 1990s, science and technology investments were not prioritized despite considerable empirical evidence from

South–East Asia and other regions showing that investment in science and technology yields direct and indirect benefits to national economies. Of all the world regions, Africa as a whole has the lowest human development index and highest poverty indicators. Food security, nutrition, healthcare, and environmental sustainability are among Africa's biggest challenge.

In the last part of the twentieth century, southern Africa, for example, was reported to have the highest prevalence of HIV and AIDS. The devastating impact of HIV and AIDS is not only exacerbated by the increase in levels of poverty; it is also a manifestation of the breakdown in the African healthcare system. Preventable diseases such as malaria are in fact one of the biggest blights afflicting the people of Africa. Yet low cost solutions are available, such as Vitamin A supplements, insecticide-treated nets, oral-hydration therapy could significantly reduce these deaths but are largely unavailable. Burden of disease and economic growth are, of course, closely related.

Apart from mineral riches Africa also has a large and valuable biodiversity that is not adequately used. It is surprising that although Africa contains 25% of the world's plant species diversity only 8% of the herbal medicines commercialized come from Africa. In a remarkable international collaboration of scientists, growers, exporters, and importers of medicinal plants from 14 different countries the publication of the African Herbal Pharmacopoeia is an example of how collaboration can lead to useful products.

Fortunately, more African leaders now view science, technology, and innovation as critical to human development. A series of developments at the international and regional levels from 2000 to date provide new sources of optimism and action. Time and time again policy-makers have underlined the importance of science-based decision-making, by inter alia calling for: integrating scientists' advice into decision-making bodies; partnerships between scientific, public and private institutions; improved collaboration between natural and social scientists, and establishing regular channels for requesting and receiving advice between scientists and policy makers; making greater use of integrated scientific assessments, risk assessments and interdisciplinary and inter-sectoral approaches, and increasing the beneficial use of local and indigenous knowledge. Strengthening and creating centers for sustainable development in developing countries are encouraged, as well as networking with and between centers of scientific excellence and between science and education for sustainable development.

Chemistry, as a central science, deals with all these areas of human activity. It touches everyone. It pervades our lives and in 1987, Jean Marie Lehn, Nobel Prize winner stated that 'A world without chemistry would be a world without synthetic material as chemistry is behind most of the innovations that have improved our lives.' The past two decades have witnessed university researchers and industrial chemists competing to use science especially chemistry, to find ingenious responses to climate change and environmental degradation. Sustainable development may have been conceptualized in different ways, but the most widely used

definition, as articulated by the World Commission on Environment and Development, is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". As such, chemistry remains the cornerstones for sustainable development, not only in Africa but also worldwide.

Yet the true impact of chemistry for sustainable development and for impacting livelihoods will be visible when different fields related to chemistry are brought together sometimes in ways that were previously not envisaged. Today the marriage of chemistry with biology to computing is key to the development of new crops, drugs, vaccines, diagnostic kits for diseases, contraceptives, and much more. Nutrition and healthcare are not the only winners from this alliance, industrial competitiveness is also a winner.

The alliance of computing to the biochemical sciences has opened up whole new areas of research and development, such as combinatorial chemistry, genomics, bioinformatics, and structural biology. Raw computing power is being harnessed to test the potential of new drugs and vaccines (combinatorial chemistry), to unfold the map of the human, animal and plant genomes (bioinformatics), and to do this in record time. Add nanotechnology to this and one begins to see the future of drug discovery and production through products, such as biosensors, biochips, smart drug delivery systems, bioelectronics, and biomaterials.

For Africa to be able to make a difference in these areas, there is a need to develop and retain a critical mass of trained and experienced researchers in all areas of science especially as scientific research is going multidisciplinary with chemistry and all its sub-disciplines as major components. This book showcases the attempts being made by some African researchers who are trying to address the development priorities of the continent. Publications deal with varied topics like nanotechnology, climate change, natural product chemistry, and biotechnology amongst others.

Expectation is high as Africa has potential and has a great future. It is expected that by 2020, Africa will have a collective GDP of 2.6 trillion dollars and with 1.1 billions Africans under the age of 20–50% are expected to be living in the cities by 2030. Africa's economic pulse has quickened and is infusing the continent with a new commercial vibrancy and with a GDP rising to around 5% from 2000 to 2009. One factor that could explain this is Africa's increased trade both internationally and regionally. Increasingly member states of the continent are spending on infrastructure and further increasing collaboration and cooperation in science and innovation.

Apart from political issues, the sustainable development of the African continent rests squarely on priority areas within the scientific domains. Critical capabilities need to be developed and will include human capacity building, reinventing African universities to retain highly qualified scientists, if not within the country of origin at least within Africa, enhancing collaboration of universities within Africa.

Other aspects are developing continent-wide regulatory measures that are effective, transparent and efficient, and aimed at promoting innovation, engaging the African diaspora, designing effective collaborations with regional, and international partners are also key considerations.

Ameenah Gurib-Fakim
J. N. Eloff