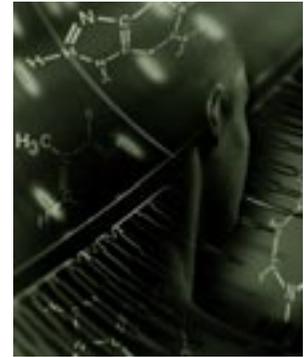


# Overview—harnessing technologies for sustainable development



*The greatest single problem and danger facing the world of the Third Millennium... is the gap in wealth and health that separates the rich and poor... The only other worry that comes close is environmental deterioration, and the two are intimately connected, indeed are only one.*

— David S. Landes, *The Wealth and Poverty of Nations*

Poverty is multidimensional and widely spread in Africa. Incomes and consumption levels are low and volatile. The available productive assets, particularly for the poor, are few and meagre, increasing vulnerability to shocks. Illiteracy, malnutrition, and ill health are prevalent, with mortality and morbidity rates high. All these conditions have led to short life spans. Worsening the situation in recent years are the spread of HIV/AIDS and the resurgence of malaria and tuberculosis.

The pervasiveness of low levels of well-being is caused by, and in turn perpetuates limited productive capacity. Undercapitalized, the production of goods and services in large parts of Africa has yet to benefit significantly from modern technological advances. Average years of schooling are inadequate, while the incidence of illness is high, contributing to low aggregate and agricultural output per worker. The low agricultural productivity is simultaneously a cause and an outcome of the degradation of an already fragile natural environment.

The low and in some cases declining productivity, the deterioration in the natural resource base, and the rapid population growth mean that development is unsustainable in most African countries. Corroborating this is the index of overall sustainability developed by the Economic Commission for Africa. The index jointly measures the economic, environmental, and institutional sustainability of African countries. Combining 27 key economic, environmental, and institutional indicators, it tracks the performance of 38 African countries in 1975–2000. The scores reveal that the number of countries with low sustainability increased (from 16 in 1975–84 to 19 in 1995–2000), while the number of those with high sustainability remained the same (only 3). More telling, within the group of 38 countries the fraction of the population living in the countries with low sustainability rose from one-third in 1975–84 to half in 1995–2000.

So, the continent urgently needs a rapid, sustained, and broad-based economic transformation that is equitable within and across generations—in short, it needs development that is sustainable. The key to achieving the transition to sustainability is realizing and enhancing

the capabilities of individuals and their communities. People who are ill, poorly fed, and living in a fragile environment can neither function effectively nor improve their capabilities. Moreover, in part because of rapid population growth, the severity of ill health, food insecurity, and environmental stress is likely to increase in the coming decades. Africa must therefore explore new and radical solutions to these problems.

The development challenge facing Africa is enormous, but it can be overcome. The development of Western Europe and the United States and, more recently, that of East Asian economies (including Japan, the Republic of Korea, and Taiwan, Province of China) corroborates this. Given the right circumstances, advances in and diffusion of technology can pull Africa out of its current state of low development. African countries can emulate the processes and policies that have promoted transitions to sustainability in other regions. Indeed, these processes and policies are better understood today than ever before. In Africa the achievements in Mauritius, for example, and the recent trends in policy reforms and economic growth in large parts of the continent signal the possibilities.

This report maintains that combating ill health (particularly that caused by HIV/AIDS, malaria, and tuberculosis), tackling food insecurity, and reducing environmental stress should be prominent objectives of the endeavour to reduce poverty and achieve sustainable development in Africa. It identifies the epidemiological and agricultural productivity transitions as the current priorities in the continent's striving towards sustainability. Recognizing that modern technology is indispensable to such transitions, the report then focuses on how the “new” technologies—particularly medical and agricultural biotechnology—can contribute.

## Sustainability—on the decline

Overall sustainability has been worsening in Africa over the past three decades. This is confirmed by the Economic Commission for Africa's index of overall sustainability, combining economic, environmental, and institutional dimensions. Cluster analysis was used to classify countries into three relatively homogeneous groups characterized as having high, moderate, and low sustainability. Only three countries, accounting for about 6.5% of the continent's population, recorded relatively high overall sustainability throughout the period (table 1).

In the decade after 1975–84 fewer countries achieved moderate overall sustainability, with more falling into the cluster for low overall sustainability. The main explanation is that the significant progress in health and education in 1985–94 was more than offset by a worsening institutional and environmental situation. In that period institutional constraints on chief executives weakened considerably in several African countries—the Democratic Republic of Congo, Ethiopia, Nigeria, and South Africa—while they remained the same in Egypt, Kenya, and Tanzania. In addition, both population density and carbon dioxide emissions increased substantially in several large countries, including Algeria, Egypt, Ethiopia, Morocco, Nigeria, and South Africa.

In the most recent period, 1995–2000, the number of countries with low overall sustainability remained about the same as in the previous one, but the share of the population

**Table 1***Overall sustainability clusters for 38 countries, 1975–2000*

Period	High		Moderate		Low	
	Number of countries	Population share (percent)	Number of countries	Population share (percent)	Number of countries	Population share (percent)
1975–84	3	7.0	19	58.9	16	34.1
1985–94	3	6.7	15	52.8	20	40.5
1995–2000	3	6.4	16	39.5	19	54.0

**Source:** Calculations by Economic Commission for Africa.

living in such countries rose—an outcome largely explained by the deterioration of economic, institutional, and environmental management in Nigeria during most of 1995–2000. In many other African countries a recovery, though still tentative, has begun. In particular, output per worker and capital per worker rose in Egypt, Ethiopia, Morocco, Tanzania, and Uganda, and civil and political rights improved significantly in many countries.

When the 38 African countries are ranked by their average overall sustainability score for all of 1975–2000, Mauritius, South Africa, Botswana, Zimbabwe, and Tunisia emerge as the top five (figure 1). At the bottom are Burundi, the Democratic Republic of Congo, Guinea, Chad, and Burkina Faso.

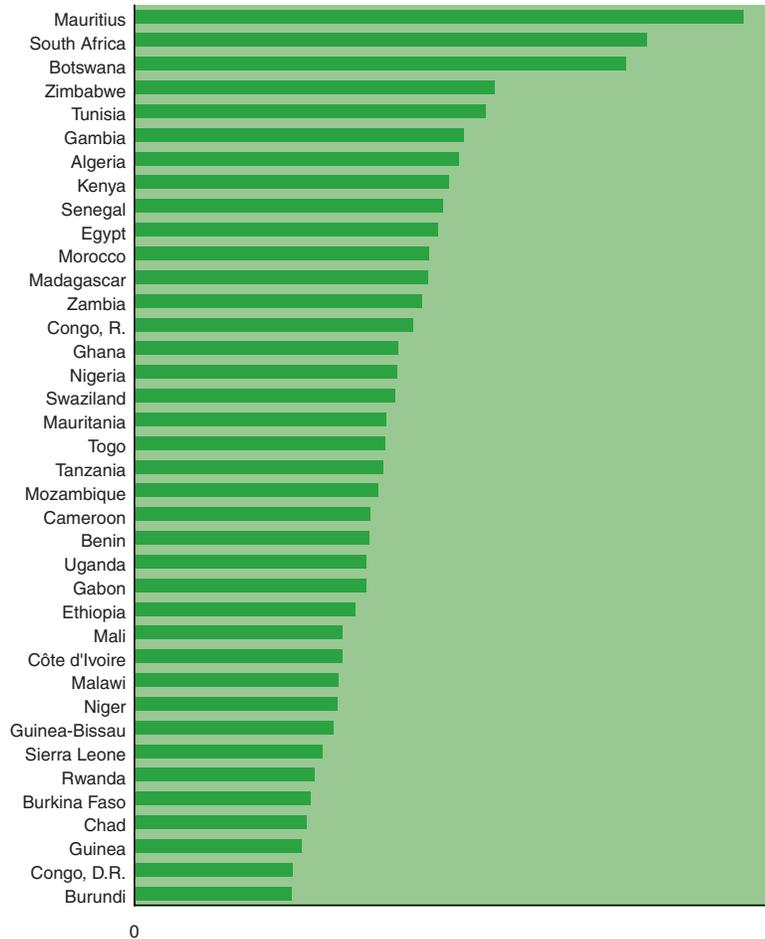
There is little surprise in the make-up of the top five. South Africa, with its large and mainly industrialized economy, is quite distinct from other African economies. Indeed, it tops the economic sustainability rankings. But Mauritius and Botswana were the star performers in economic growth for the last three decades. Socio-political stability was also quite good in these countries, with Mauritius and Botswana ranking as the top two in institutional sustainability. Similarly, Tunisia and, until recently, Zimbabwe made reasonable progress in the economic and institutional dimensions.

That Zimbabwe ranks among the top five may be puzzling in light of its recent performance. The reason for this outcome is that until recently the country had been doing rather well, particularly in economic and institutional terms. Thus while Zimbabwe ranks only 12th in overall sustainability and 23rd in institutional sustainability in 1995–2000, it ranks 4th and 6th on these measures in 1985–94.

A blemish on the sustainability record of the top five is their performance in environmental sustainability. Mauritius, Tunisia, and Zimbabwe rank among the bottom five countries in environmental sustainability, and Botswana 30th among the 38 countries. Only South Africa, ranked 19th, does better in this dimension of sustainability. For these top performers, environmental concerns increasingly are becoming binding constraints on further improvement in the overall well-being of their populations. One lesson from this experience is that countries can do well for a while without giving due consideration to environmental factors, but this may not last long.

**Figure 1**

**Overall sustainability index scores by country, 1975–2000**



**Note:** The index scores shown are averages of the scores for 1975–2000. The scores are standardized to range from 0 to 1.

**Source:** Calculations by Economic Commission for Africa.

The bottom five countries are also broadly consistent with expectations. Despite its huge potential, the Democratic Republic of Congo has been misgoverned for decades. More recently it has been crippled by civil war. Burundi’s history is punctuated by ethnic tensions and civil conflict. Until recently Chad suffered from similar problems of instability. For Burkina Faso the main problem is an unsatisfactory economic growth record. Indeed, almost all these countries rank low in economic and institutional sustainability. Burundi, the Democratic Republic of Congo, and Chad rank among the bottom five in institutional sustainability, while Guinea ranks 30th and Burkina Faso 27th. In economic sustainability Burkina Faso ranks 38th, Guinea 37th, Chad 32nd, Burundi 30th, and the Democratic Republic of Congo 29th. But these countries rank relatively high in environmental sustainability—from 2nd to 11th. This contrast highlights the fact that economic performance (or the lack of it) has a negative (or positive) impact on the environment.

## The transitions

To move rapidly to sustainable development, Africa needs to achieve two critical transitions: an epidemiological transition, to combat ill health, and an agricultural productivity transition, to address food insecurity.

### The epidemiological transition

*Good health is the first and greatest of all blessings and the first of all liberties.*

—Laura D’Andrea Tyson paraphrasing Lord Chesterfield

*Once a disease like AIDS reaches the kind of proportions we see in Sub-Saharan Africa, it is no longer a disease—it is a disaster.*

—Peter Walker, Director of Disaster Policy, International Federation of Red Cross and Red Crescent Societies

The epidemiological transition delivers longer and healthier life to human society, primarily through reductions in morbidity and mortality due to infectious and parasitic diseases. Through its impact on fertility behaviour, this transition also contributes to the demographic transition from high birth and death rates to low ones.

The epidemiological transition in Africa progressed appreciably in the decades after World War II. Over the past 40 years the incidence of infectious and parasitic diseases has been reduced enough so that today fewer infants and children die, people live longer, and birth rates are lower. Despite these improvements, the state of health in the continent remains unsatisfactory. Mortality rates are the highest in the world, and overall life expectancy and disability-adjusted life expectancy the shortest.

Moreover, the gains achieved by Africa are being undermined by the emergence of new diseases, such as the acquired immunodeficiency syndrome (AIDS), and the re-emergence of old ones, such as malaria and tuberculosis, as leading causes of death. Both malaria and tuberculosis have developed strong resistance to existing drugs, making current treatments ineffective. AIDS, which is caused by the human immunodeficiency virus (HIV), became the leading killer in Sub-Saharan Africa at the end of the 1990s (Medilinks 2001). Since the epidemic began, more than 20 million people worldwide have died of HIV/AIDS-related causes (UNAIDS 2000, 2002). Moreover, HIV compounds tuberculosis. People infected with HIV are more vulnerable to other infections. In some countries in Africa up to half the people living with HIV also suffer from tuberculosis (Medilinks 2001).

Together, HIV/AIDS, malaria, and tuberculosis have devastated populations through human losses and suffering. In at least 15 Sub-Saharan countries the population is expected to be as much as 3.8% smaller in 2005 than it would have been without HIV/AIDS, with the working-age population the most affected. In addition to the human cost, these diseases cause work loss and school dropouts, hinder savings and investment, and overwhelm

health services, undermining the productive capacity of a country, furthering social distress, and perpetuating poverty.

As a direct result of HIV/AIDS, the growth of gross domestic product (GDP) in Africa is expected to fall by 0.5–2.6% a year on average (Greener 2002). If malaria had been eliminated years ago, Africa's GDP would be as much as \$100 billion greater (Medilinks 2001). And in countries with a high burden of tuberculosis, annual productivity losses due to the disease amount to an estimated 4–7% of GDP (Stop TB Initiative 2002).

The combined socio-economic burden of these diseases has led Sub-Saharan countries towards major crises that threaten to reverse decades of development gains and undermine national security. The damage from these diseases clearly calls for accelerating the epidemiological transition in Africa. Indeed, that is the most important development challenge for many African countries. Meeting it requires a prudent exploitation of techniques and products developed by recent advances in medical biotechnology.

### **The agricultural productivity transition**

*A person who has food has many problems. A person who has no food has only one problem.*

—Chinese proverb

The agricultural productivity transition involves increasing agricultural production by raising output per unit of land through advances in knowledge and technology rather than by expanding the area cultivated. Historical evidence clearly shows that for most countries this transition is essential for securing access to enough food for a healthy life for all people and at all times.

Agricultural productivity is low in Africa, particularly in Sub-Saharan Africa. In the late 1990s cereal yields in Sub-Saharan Africa were about 40% of the world average—having fallen by 0.7% a year between 1985 and 1995—and milk yields about 16% of the average. Other crops and agricultural products showed similar gaps in yield. With about 70% of all Africans earning their livelihood from agriculture, low and in some cases falling agricultural productivity means serious poverty and food insecurity. Exacerbating the situation are rapid population growth and urbanization.

About a third of Africa's population is undernourished, while a similar share of its children are underweight. Of those who survive their childhood, many will suffer from impaired immune systems, poor cognitive development, and lower productivity throughout their lives. As adults, their ability to ensure good nutrition for their children will be compromised, perpetuating the vicious cycle. Indeed, it is only in South Asia and Sub-Saharan Africa that the number of malnourished people is projected to increase in the current decade.

The growing demands for food and nutrition are not being met in a sustainable manner. Farmers have tried to overcome declining yields by expanding croplands and grazing areas, an environmentally unsustainable option. Given limits on crop area expansion and increased demands on land already in production, physical and chemical soil degradation becomes a greater concern. Africa's tropical forests are fragile, quickly losing productive potential when under stress. Roughly 5 million hectares of forest are lost annually, most to