

Chapter 2: Economic Growth and Human Development Challenges for Science, Technology and Innovation in Africa

2.1 Introduction

In virtually all economic development programmes across the globe, the primary objective is to improve the quality of life of the general population. Economic growth is generally assumed to fulfil that objective. In Africa, however, there is the increasingly widespread phenomenon of 'jobless growth' where economic growth rates have risen in recent years, unaccompanied by any significant improvement in most of the indicators of human development. In many cases, this phenomenon is associated with the natural resource trap that most of the countries on the continent seem to be locked in. The implications of increasing unemployment on human development, measured by the behaviour of human development indices across the continent, are obvious. The growing gap between Africa, and especially sub-Saharan Africa, and most of the rest of the world, not in growth rates but rather in the evolution of economic systems and the ensuing trading and investment patterns, is entrenching this decoupling of economic growth and human development within the structure of most African economies. The implications for development policy are still unclear. This chapter examines the relationship between growth and development from the perspective of systems of innovation and draws conclusions about the role of human development in economic development.

One of the possible reasons for the enduring low correlation between economic growth and human development is the divide between the goals and the instruments of the growth and development process. Most of the accepted measures of human development are usually couched solely as the objective of economic growth and development policy. Their attainment is seen as contingent on the successful deployment of conventional macroeconomic policy tools, along with industrial and trade policies. Where these objectives remain unattained for sustained periods of time, especially in developing contexts, remedial action is often designed outside the sphere of economic planning in order to alleviate extreme cases of human deprivation through social policy strategies.

It is generally acknowledged that economic policies across Africa, especially sub-Saharan Africa, have on the whole failed to address the human development challenge adequately. To a certain extent, the cause of this enduring failure can be traced to the lack of clarity about the underlying, contesting ideological bases of the various policy formulations. Given the deep divides in contending ideologies and the paradigmatic underpinnings of policies, it is quite important to be explicit about what we may

term the various 'languages' of alternative sets of growth and development strategies. Failure to do so would result in a confusing Babel of paradigms within the same policy formulation, based on ad hoc and mostly unstated assumptions. When this happens, policy becomes fragmentary and ineffective in attaining its objectives.

In this chapter, a systems of innovation approach to development is used in an attempt to address these conceptual divides and propose a framework for the design of a new development path more conducive to human development in Africa. Most of the literature on innovation systems focuses on national systems of innovation, but we are acutely aware of the colonial definition of African nations that determined the post-colonial map of states across the continent. We are aware of the implications of this ersatz creation of political entities on the viability of national systems of innovation in Africa and hence of the need to transcend this construct and move to a continental system of innovation in the interests of creating a regional economy that is more feasibly conducive to people-oriented growth and development (Muchie, 2003; Scerri, 2003; Maharajh, 2008).

The concept of systems of innovation is subject to a range of definitions and interpretations. In the past, R&D surveys and, to a lesser extent, innovation surveys, restricted their analysis to formal institutional frameworks directly relevant to the production, diffusion and absorption of technological innovations. A more recent and broader approach has extended the definition of innovation to include organisational and institutional change (OECD/Eurostat, 2005) within an organic or evolutionary context of search under conditions of less than full and imperfect information. This broader approach brings to the analytical foreground the role of history in the particular systems that have evolved, and consequently highlights the specificity of individual systems (Lundvall, 1992; Cassiolato, Lastres & Maciel, 2003). The approach is broadened further according to the type of institutions that are considered to be relevant, which depends partly on the particular definition of innovation that is adopted. The narrower the definition, the more restricted the focus becomes to institutions that are directly relevant to technological innovation. The broader the definition of innovation, and hence of the system of innovation, the wider the range of institutions becomes that are considered as pertinent to the analysis of systems.

There is also a wide range of informal institutions, in the form of established routines, practices and social formations, which are brought into consideration when a broader definition of the system of innovation is adopted, especially in developing countries. In this context, history becomes strongly relevant to the analysis of systems of innovation. Informal institutions are defined in various ways, and it is certainly difficult to identify a particular practice or social formation as a valid object of analysis within an evolutionary analytical framework. The analysis of the effects of informal institutions on the evolution of national systems of innovation is also complex. Consequently, it is often difficult to formulate and deploy strategy to align informal institutions with national development objectives.

It is within the web of these informal and formal institutions that tacit knowledge is formed. In a world economy in which the effective cost of the mobility of resources is approaching zero and most codified knowledge is free and transferred virtually instantly and freely, it is ultimately tacit knowledge that defines the competitive advantage of nations and the specificity of their systems of innovation. We also need to keep in mind that the absorption and use of the freely available codified knowledge presumes human capital development, which is strongly influenced by context specific pools of tacit knowledge.

2.2 Population and economic growth

From an innovation systems perspective, human capital forms the core of technological capabilities, broad-based absorptive capacity for innovation, core competencies and the competitive advantage of nations. In its original formulation, the concept of 'human capital' was presented as a means of placing the human element within a production framework. Within this construct, human beings are owners of their own capital, which essentially consists of knowledge and skills, which they proceed to 'rent' out on the market for a return. The stock of human capital is not regarded as constant, but may change due to investment and depreciation. Within the original formulation, education is considered to be the main determinant of the human capital formation process and to a certain, and possibly largely implicit, extent, the onus of human capital formation falls on the individual, or at most on the family unit.

However, the concept of human capital has evolved beyond its original simple neoclassical formulation. We therefore need to explore the various approaches to human capital development, paying special attention to the possible ideological underpinnings of this concept that could possibly have conflicting implications for development policy. Conventionally, the concept of human capital has been adopted, and perhaps even appropriated, by neoliberal ideology to shift the responsibility for human capital formation, and the appropriation of the returns on it, to the individual. From this perspective, human capital becomes almost indistinguishable from other types of capital, and every individual is consequently transformed into an owner of capital (in other words, a capitalist). However, human capital cannot be easily equated with other forms of capital (see Bowles & Gintis, 1975).

If we move away from a fully determinate production function construct, human capital formation becomes a social construct. The nature of its ownership, even in a democratic political economy, bears little relevance to the control over its deployment and over the returns on it. In other words, there is a substantive difference between wage employment and portfolio investment. The restrictive neoclassical and recent neoliberal appropriation of the concept of human capital has led to its repudiation by the more progressive schools of political economy and the proposal of 'human capabilities' (Sen, 1999) as an alternative contending construct. However, we feel that the original formulation of the concept of human capital is sufficiently malleable to extend its formulation to incorporate a whole gamut of social conditions as the determinants of the formation of human capital. We could further enhance the analytical tractability of this concept by considering it in conjunction with network capital and social capital in order to better capture the role of human capital, in its extended formulation, in the functioning and evolution of the national system of innovation. Considerations of class formations and other historical and cultural determinants of the inequality of access can thus be introduced to the analysis of human capital formation. This approach serves to fundamentally shift the ideological basis of the concept of human capital and hence render its application more appropriate in a development context.

We also need to differentiate between the various levels at which this concept applies. This depends primarily on the specific definition of the national system of innovation that is adopted. The further we move away from a narrow definition (usually reflecting the system of science and technology) to a broader one, the wider our definition of the concept becomes, both in terms of the range and levels of skills and knowledge that we consider and the determinants that we include. This introduces framework conditions such as the provision of education, healthcare and government support for training and life-

long learning, as well as culture and history. Throughout the rest of the chapter, framework conditions, human capital and their role in development will be a recurring theme.

Our approach to the relationship between populations and economic growth stems from the adoption of what we have come to call 'the knowledge economy'. In a number of respects, we are sceptical about the way in which the term is currently used, which often implies that this is a recent phenomenon. Instead we propose that knowledge has always formed the basis of economies. What may be specific to the modern age is the increasingly rapid acceleration of change in the knowledge base of economies and the increasing rapidity of techno-economic paradigm shifts (Freeman and Perez, 1988; Perez, 2009). Given the social and cultural grounding of systems of innovation, this also implies a rapidly changing web of informal institutions, as societies and cultures strain to adapt to rapidly shifting global environments. Again, culture and history act as framework conditions that influence human development.

An initial attempt at mapping the human capital contour of specific innovation systems would use demographics to provide the age segmentation and education profile of populations and then perhaps use these in a preliminary comparative study. The analysis could then become the basis for an assessment of the potential pool of human capital within a system, although it would not necessarily indicate the role of human capital in the functioning of the system. For that, an analysis would be required of the institutions that mediate between human capital and the specific system of innovation.

The African continent has one of the youngest populations in the world. Annex 1 lists the most recent Human Development Index (HDI) statistics for Africa, clearly indicating the weak HDI rank positions of all African countries. The continent hosts 19 of the lowest-scoring countries in the sample of 182 countries. The combination of the age distribution in Africa with the composite of life expectancy, education and per capita gross domestic product (GDP) provides a stark indication of the challenges, and simultaneously of the possibilities for the development of broad-based human capital on the continent.

The challenges are obvious: African countries have among the lowest life expectancies in the world; participation rates in schools are low; and, while GDP per capita may be high in a number of countries, this is often offset by the inequality illustrated by high Gini coefficients. The reasons for these constraints are numerous, but, whatever the historical origins, the result has been widespread institutional failure that has become self-reinforcing and self-perpetuating. From the perspective of the systems of innovation approach, this enduring shortfall in human capital poses the foremost obstacle to achieving a sustainable development process. It is here that the goals and the strategic instruments of development policy conflate and the apparent paradox arises that the achievement of the long-term objective of poverty reduction in its various facets depends upon the alleviation of the conditions of poverty in the short term.

It is impossible to imagine that development can occur without first addressing most of the factors used to determine the Human Development index. At the same time, however, Africa's young population of just over a billion (Asnford, 2007) could, given appropriate conditions for the guaranteed development of human and social capital, provide an impressive base for the development of economies within the continent and for the continent as a whole. Such a population would provide a strong stimulus to the development of the national and continental systems of innovation from both the supply side and the

demand side. On the supply side, a young population with years of productive employment and learning ahead of it would provide the human capital base for the evolution of long-term viable systems of innovation, whether national or continental. On the demand side, a large internal population with rising incomes and quality of life would provide the scale of an internal market that has typically provided the basis for inward industrialisation as the precursor to the emergence of new, highly competitive economies, starting with Japan and the Asian Tigers, and more recently Brazil, China and India.

2.3 Science, technology and innovation: Institutions and policies

Within an economic context, science, technology and innovation (STI) usually refers to various aspects of technology and technological innovations. As long as the term is restricted to technology, the definition of STI institutions would be limited to formal institutions that are directly engaged in the production of technological innovations, such as R&D divisions within enterprises, the public sector and the tertiary education sector, as well as institutions that support technological innovation through incentives and training. On that basis, the definition of 'the national system of innovation' tends to be synonymous with 'the system of science and technology'. However, the consideration of systems of innovation as economic systems rather than technological systems has considerably widened the range of institutions, as well as the related policy terrains, that should now be included in the STI category.

The consideration of which institutions to consider as relevant to STI depends to a large extent on the definition of the national system of innovation that is adopted, and whether innovation is considered to be sectoral or broadly systemic. If the grounding of innovation (even if restricted to technological innovation) is seen as lying within the broad context of the political economy, the category of STI institutions widens to include aspects of policy that are ancillary to the S&T sector. If the concept of innovation is broad enough to encompass all change, and if systems are seen as being in a permanent state of flux, then it is difficult to set limits on what could be included as an STI policy or STI institution. Thus, for example, a decision to review state support for single-parent households has implications for the welfare and education of children, which in turn has inter-generational effects on the development of the broad human capital base, which in turn determines the long-term development of technological capabilities, core competencies and the competitive advantage of nations. This approach to planning is more difficult than segmenting the planning framework into clearly defined, and implicitly separate, sectors. However, we could also propose that the failure of development planning can often be traced to the inability to draw out the complex interdependencies of all the facets of national systems of innovation and consequently to predict comprehensively the effects of particular policy initiatives.

The common focus on the higher end of the capability spectrum (namely, scientists and engineers, R&D laboratories, technological creativity and scientific output) tends to reflect the system of science and technology more than the system of innovation. The range of institutions considered in innovation surveys reflects those that are directly engaged in one way or another with formal R&D (OECD, 1992; OECD/Eurostat, 1997, 2005). It is therefore possible for a distorted picture of the system of innovation to emerge. In developed industrialised countries, this distortion may not necessarily be problematic, since we can reasonably assume that the requisite institutional context is stable and suited for the translation of science and technology (S&T) activity into economic prosperity. In the case of developing

economies, however, we cannot so easily make similar assumptions about the transmission mechanisms linking technological performance with economic development. Thus, for example, the pursuit of some goal regarding expenditure on R&D as a proportion of GDP as the benchmark for STI planning might, in the absence of appropriate sets of complementary policies, have little or no effect on the development process. In fact, the isolated pursuit of such an objective might set up a misleading diagnostic of the health of a particular system of innovation. It could also prove to be a poor indicator of the nature and extent of innovation in developing economies. The relationship between innovation activity that is captured by formal institutions, such as R&D laboratories and universities, and informal innovation might, for example, be such that too excessive a focus on formal institutions could seriously underestimate innovation activity. This is illustrated by the higher propensity to innovate than to conduct R&D in firms in most member countries of the Organisation for Economic Cooperation and Development (OECD) and in African countries covered in the *African innovation Outlook* (see Chapter 4).

It was partly for this reason that the *Oslo Manual*, in its third revision (OECD/Eurostat, 2005), expanded the definition of innovation from one dealing only with products, and the transformation of inputs to products, to include industrial organisation, including the use of management practices and strategies, and market development. The word 'technological' was dropped from the definition. The *Manual* also made reference to the importance of framework conditions such as those resulting from regulation, history and culture. This change provided an explicit role for institutions of all kinds in the analysis of innovation and systems of innovation.

The spread of STI institutions across Africa is quite uneven, and probably becomes more so as the category of institutions that we consider as relevant widens. We can therefore map this distribution at various levels of inclusivity, until possibly we end up mapping the entirety of economic institutions of specific countries. As the complexity of our institutional mapping increases, so would the probability of unevenness in the institutional map of the continent. The same applies to STI policies. As the definition of policies that are relevant to the evolution of systems of innovation grows, so does the level of complexity of the interaction among policies and the degree of differentiation among systems of innovation across Africa.

2.4 Role of science, technology and innovation in development

Broadly interpreted, STI is now accepted as the foundation of economic change (Dosi *et al.*, 1988; Freeman, 1993; Lundvall, 1992; Nelson, 1993; OECD, 1997; Cassiolato *et al.*, 2003; Muchie, Lundvall and Gammeltoft, 2003; Maharajh, 2008; among others). This is, however, a relatively recent development in economic theory. The focus on innovation as the engine for economic change had its heyday with Schumpeter's extensive incorporation of innovation, defined to include considerably more than technological innovation, in his theory of economic cycles. This was the culmination of the positioning of technological change among a number of classical economists, including Adam Smith, Friedrich List and Karl Marx. However, with the emergence of the neoclassical model as the dominant economic paradigm, the analysis of innovation and its role in economic dynamics was considerably impoverished. This was due to the extremely restrictive assumptions of neoclassical economics, particularly with respect to the full and perfect information context within which economic agents made their constrained optimisation decisions.

Given the obsession of this paradigm with finding determinate and unique solutions to fully specified models, there was little scope for the analysis of technological change in any but the most stylistic but analytically empty fashion.

The resurgence of interest in the nature of innovation and its role in economic change came about in the late 1960s and 1970s due to the rapid growth in Japanese productivity, which on many fronts was outstripping the USA (Freeman, 1987). This gave rise to a wave of research aimed at pinning down the residual thrown up by Solow's (1956) analysis of US productivity based on production function. The re-emergence of evolutionary economics and the national systems of innovation stemming from that began with the works of Nelson and Winter (1982) and culminated in the collection of works edited by Dosi *et al.* (1988) towards the end of the 1980s and the work of Lundvall (1992) and Freeman (1993) in the early 1990s. Since then, the concept has led to the expansion of R&D surveys based on the *Frascati Manual* (OECD, 2002) to innovation surveys guided by the *Oslo Manual* (OECD, 1992, 1997; OECD/Eurostat, 1997, 2005), which led to the first Eurostat Community Innovation Surveys (CIS). The CIS template has been revised several times since the early 1990s. Five CIS surveys have been carried out since 1992, and adaptations have been suggested to extend the capturing of innovation activities, incorporating service innovations, organisational change, management practices, design and marketing.

Attempts have also been made to render this instrument more appropriate to the conditions of developing economies (see Blankley *et al.*, 2006, for some of the debates on the relevance of the CIS in developing country contexts). The adoption of innovation surveys and of STI indicators measured in these surveys has been rapid across industrialised economies but relatively slow in developing economies, although we must be careful not to lump developing economies into a single category. Generally speaking, the propensity to survey innovation in specific countries depends on the countries' state resources and administrative capacity, as well as on the extent to which innovation is prioritised in the national policy framework. In poorer countries, the combination of these two factors usually militates against surveying. A possible way of addressing this would be to make innovation more prominent in the policy makers' environment through a comprehensive re-articulation of the nature of innovation and its role in the development process. In that way, the adoption of the broad definition of innovation assumes added pragmatic and strategic value beyond its theoretical rationale.

In the relatively sudden rush to adopt the national systems of innovation concept in economic planning, however, there has been a tendency to fail to distinguish adequately between different categories of economies and to forget that development implies more than simply growth along a given trajectory. Almost by definition, development also requires changes in structures that are seen to be unsuitable for the requirements of raising the quality of life of populations to acceptable and sustainable levels. From this perspective, there is always the possibility, and perhaps even the probability, that STI, while being a stimulus to economic growth, may serve to entrench current structures that are not conducive to the requirements of the development process, especially in cases of strong knowledge and technology dependence. It is in such cases, where the adoption of the national system of innovation concept reflects primarily the system of science and technology, that the phenomenon of jobless growth is usually encountered. STI can only be used as the lever for structural transformation if it is engaged within a planning context designed to alter historically determined structures. This, in turn, can only be done through the recognition of the historical and structural specificities that form the basis of the concept of national systems of innovation.

2.5 Diversification of African economies

The foundation for a successful process of economic integration lies in the degree of diversity of the economy and the production base of the prospective participant countries. The relationship of diversity may lie across several axes. These could be primary producer economies with manufacturing-based economies; manufacturing economies among themselves; service sector-based economies with both primary and secondary sector based economies; as well as with other service-based economies. The rationale underlying this base for integration lies in the requirement for the existence of different reciprocal markets for trade and investment among the prospective partner countries, as well as for the flow of knowledge and human capital. The relationship between primary producers is the least likely of all the possible partnership combinations among trading and investment partners to exhibit diversity and complementarities. A group of primary producers is most likely to trade with and draw investment from countries outside the group.

The neo-colonial experience and the post-colonial heritage of the African continent have, as already indicated, locked most African economies into the natural resource trap. Relatively speaking, South Africa has a national innovation system with a structurally different base from the rest of the sub-continent and the continent as a whole. However, the relationship of the South African economy with the non-African global economy still positions it as a peripheral trader, with a competitive advantage in the primary sector, but importing commodities that require a high intensity of skills and knowledge to produce. The degree of diversification among African economies is low (see Table 2.1) and affords limited opportunities for intra-African trade in comparison with trade flows between the continent and the rest of the world. This is mitigated to some extent by the entry of the post-apartheid South African economy as a legitimate member of the African Union. South African investment across Africa has risen remarkably since 1994, as have its exports of skills and knowledge-intensive goods and services to the rest of the continent. Within the sub-continent and Africa as a whole, South Africa has therefore assumed a central economic position. However, this asymmetry creates problems for the integration of economies in Africa, as will be discussed further on.

Table 2.1: Sector share of change in real GDP for Africa (2002-2007)

Sector	Percentage
Resources*	24
Wholesale and retail	13
Agriculture	12
Transport, communication	10
Manufacturing	9
Financial intermediation	6
Public administration	6
Construction	5
Real estate, business services	5
Tourism	2
Utilities	2
Other services (education, health, household services and social services)	6

Note:

100% = US\$235 billion
 * Government spending from resource-generated revenue contributed an additional eight percentage points.

This similarity in economic structures, in the narrow export base and in competitive capabilities based on natural-resource endowments, limits the scope for complementarities in production and consumption. This explains how South Africa, the new arrival on the continent, with its relatively highly diversified production base, has rapidly assumed its dominant role as the major exporter across Africa, particularly in sub-Saharan Africa. The general similarity of economic structures in most African states thus severely constrains the potential for trade and cross-border investment, except for a small group of economies. Leke et al. (2010) identify four countries on the continent as having diversified economies and regard these as 'Africa's growth engines', namely, Egypt, Morocco, South Africa and Tunisia, stating that these countries:

... are already broadly diversified. Manufacturing and services together total 83 percent of their combined GDP. Domestic services, such as construction, banking, telecom, and retailing, have accounted for more than 70 percent of their growth since 2000. They are among the continent's richest economies and have the least volatile GDP growth. With all the necessary ingredients for further expansion, they stand to benefit greatly from increasing ties to the global economy. (Leke et al. (2010: 7)

These countries, with structures that demonstrate several of the conditions for take-off into sustained growth and development, represent just over 17% of the population of Africa (calculated from the demographic statistics in the *African Statistical Yearbook* [AfDB, 2010]).

The oil producers on the African continent are Algeria, Angola, Chad, Republic of the Congo, Equatorial Guinea, Gabon, Libya and Nigeria. The share of manufacturing and services in the GDP of these countries is not only considerably lower than in the diversified economies on the continent, but also significantly lower than in other major oil exporters across the world. The economic fortunes of these countries are therefore strongly tied to the global market price for oil. Other countries that are virtually single-commodity producers are Zambia (copper) and Mozambique (aluminium). Some countries (such as Cameroon, Ghana, Kenya, Senegal, Tanzania and Uganda) are at different stages of early economic diversification. Other economies (such as the Democratic Republic of the Congo, Ethiopia, Mali and Sierra Leone) are still caught in an extreme poverty trap.

The proportion of diversified economies on the continent (four out of 52) is worryingly low and will have to rise significantly and rapidly to provide the basis for a feasible programme of continental integration. The geographic distribution of the 'growth engines' on the continent is also particularly perturbing, since it reinforces the divide between Northern Africa and sub-Saharan Africa, which will be discussed further. Effectively, if the continent is divided into two regions, radically different development trajectories can be observed, with only one diversified economy within sub-Saharan Africa, certainly not enough to act as the base for the intra-regional, multidirectional trade and investment flows that would form the fabric of an integrated regional system of innovation.

Tables 2.2 and 2.3 depict Africa's export and import flows with itself as a proportion of its total export flows. In both cases, the intra-African trade is miniscule compared with its trade with the rest of the world. The averages for the period 2000–2007 are 8.5% for intra-African exports as a share of the continent's total exports, and an average of 9% for the equivalent indicator for imports. These figures have remained quite stable over the eight-year period under consideration.

Table 2.2: African exports (US\$ millions) (2000-2007)

	2000	2001	2002	2003	2004	2005	2006	2007	Average 2001-2007
A	12 044	11 438	13 130	15 603	19 196	23 215	28 050	35 573	19 781
B	153 435	134 841	141 167	173 467	222 532	286 563	347 875	400 906	232 536
C	2.4	2.2	2.2	2.3	2.4	2.7	2.9	2.9	2.5
D	7.8	8.5	9.3	9.0	8.6	8.1	8.1	8.9	8.5

Note:

A=Intra-African exports

B=African exports to the world

C=Africa's share of total world exports (%)

D=Intra-African exports as a share of African exports to the world (%)

Source: ECA (2009)

Table 2.3: African imports (US\$ millions) (2000-2007)

	2000	2001	2002	2003	2004	2005	2006	2007	Average 2001-2007
A	11 631	12 466	13 224	15 572	20 994	24 854	31 660	39 565	21 246
B	133 416	129 508	144 445	176 929	232 189	273 509	329 785	418 931	229 839
C	9	10	9	9	9	9	10	9	9
D	6 653 669	6 414 806	6 664 703	7 771 121	9 462 990	10 776 488	1 237 928	14 056 584	9 267 266
E	2	2	2	2	2	3	3	3	2

Note:

A=Intra-African imports

B=African imports from the world

C=Share of Intra-African imports to Africa's total imports (%)

D=World imports

E=Share of Africa's imports in world imports (%)

Source: ECA (2009)

The diversification of African economies away from the primary sector is therefore not only required for the structural transformation of the internal economy, but is also a pre-requisite for the development of an integrated regional market for goods and services, as well as for financial and physical capital, and labour (human capital). In turn, we may argue that the absence of an integrated economic region poses one of the more formidable obstacles to the diversification of the bases of individual national systems of innovation. We thus find ourselves in a double bind, and specific policies are required to break the mutually constraining forces of local structures and regional contexts. These include policies to encourage diversification, trade and mobility, coupled with human resource development to provide the skilled labour required for diversification and the market for the resulting goods and services, which could lead to increased trade within Africa.

Table 2.4: intra-African trade by economic grouping (2008)

Economic grouping	AMU	CAEMC	COMESA	ECCAS	ECOWAS	FRANC ZONE	SADC	WAEMU	Africa	World
Imports from (%)	(% of total imports)									
AMU	4.8	0.2	1.7	0.2	0.9	0.8	0.1	0.6	6.7	100.0
CAEMC	1.2	2.6	0.6	3.2	2.6	3.7	1.0	1.1	7.6	100.0
COMESA	1.8	0.1	3.7	1.0	0.2	0.2	2.7	0.1	7.4	100.0
ECCAS	0.5	0.9	1.2	1.3	0.9	1.3	7.8	0.4	10.5	100.0
ECOWAS	0.5	1.3	0.2	1.5	7.4	5.6	2.0	4.3	11.2	100.0
FRANC ZONE	1.1	1.5	0.5	1.9	9.8	6.5	0.9	5.1	13.3	100.0
SADC	0.2	0.1	6.0	1.9	1.2	0.4	9.9	0.2	12.4	100.0
WAEMU	1.0	1.0	0.5	1.4	12.9	7.8	0.9	6.8	15.9	100.0
Africa	1.6	0.5	3.0	1.2	2.3	1.7	3.7	1.2	9.3	100.0
Exports to (%)	(% of total exports)									
AMU	2.5	0.1	1.2	0.1	0.6	0.5	0.1	0.4	3.9	100.0
CAEMC	0.3	0.8	0.2	1.0	0.9	1.3	0.3	0.5	2.4	100.0
COMESA	1.6	0.1	4.3	1.1	0.2	0.2	3.1	0.1	8.0	100.0
ECCAS	0.1	0.3	0.4	0.5	0.4	0.5	2.9	0.2	4.0	100.0
ECOWAS	0.3	1.4	0.2	1.6	8.0	5.9	2.1	4.6	11.7	100.0
FRANC ZONE	0.7	1.2	0.4	1.5	7.9	5.3	0.7	4.1	10.5	100.0
SADC	0.3	0.1	6.1	1.9	1.2	0.4	9.9	0.2	12.7	100.0
WAEMU	1.9	2.1	1.1	3.1	28.3	17.1	2.0	14.9	34.4	100.0
Africa	1.2	0.4	2.8	1.2	2.3	1.6	3.5	1.2	8.5	100.0

Source: African Statistical Yearbook (AfDB, 2010)

Note:

- AMU (Arab Maghreb Union)
 CAEMC (Central African Economic and Monetary Community)
 COMESA (Common Market for Eastern and Southern Africa)
 ECCAS (Economic Community of Central African States)
 ECOWAS (Economic Community of West African States)
 FRANC ZONE (Communauté Financière Africaine)
 SADC (Southern African Development Community)
 WAEMU (West African Economic and Monetary Union)

Table 2.4 shows intra-African trade flows by regional economic communities and provides a useful picture of the enduring lack of a sufficiently sound trading base for economic integration on the continent. Conversely, the existing trading patterns within the internal African market, which show that less than 10% of all trade requirements are catered for internally, provide a strong indication of the possibilities for internal trade, given a coherent drive towards the diversification of the production base across the continent.

The investment linkages among African economies, compared to those with the rest of the world, are also still weak. As Page and De Veide (2004: 20) point out:

Most investment in Africa does not come from other African countries, because of the important shares of the EU and the US. Total inward stocks are \$167 billion, dwarfing total African outward investment of \$40 billion. Perhaps more surprisingly, most African investment does not go to other African countries because of the very high share of South African investment which goes to the EU. This was \$15 billion in 2002, i.e. over 40% of total African outward stock. In addition, \$2.3 billion of South African investment was in the US and 0.7 billion in Australia, another 10%. Only \$1.4 billion of South African outward stocks were in other African countries, accounting for 3.6% of total African outward stock, and under 1% of total African inward stock.

To a large extent, intra-African foreign direct investment (FDI) is limited by the investment constraints of relatively undiversified economies, but there is still scope for an expanded set of investment linkages, given the low proportion of Africa-directed FDI within Africa's total outward FDI. The promise of the large internal market for economies of both scale and scope applies also to innovation and the possibilities of developing appropriate innovation for large internal markets.

2.6 Macroeconomic conditions and policy

If the theoretical base for understanding economies and the development process shifts from orthodox neoclassical economics to political economy framed within an evolutionary articulation, the identification of the economic 'fundamentals' shifts accordingly. Following Nelson (1993), Freeman (1993) and Lundvall (1992), the fundamental determinants of the long-term structural transformation process required for sustainable development that equitably enhances the quality of life of the population relate more to the appropriate conditions for improving learning outcomes and capability formation at the base of the economy. From this perspective, fiscal and monetary policies become the supporting policy tools for this long-term process. In this case, it may well be decided that appropriately conceived and implemented redistribution would take precedence over growth-driven policy options. The development of sound governance and a healthy and participatory civil society, and the fostering of an economic as well as constitutional democracy, would be brought to the fore of the planners' canvas, drawn in as legitimate tools of economic policy instead of being relegated to the spheres of social and administrative policy.

The post-colonial state is often referred to with the implication of commonalities, or even homogeneity, among previously occupied territories, which is at odds with the range of diversity among the nation states that emerged after 1945. This diversity is reflected in the examples of successful development of various types and to several degrees as well as those of failed development, mostly within Africa and Western Asia. The examples of successful development have been associated, almost inevitably, with those cases where the support of human capital development, in its various forms, was at the centre of policy. In such cases, sustainable international competitiveness was based on productivity gains rather than overtly cheap labour. The conventional tools of economic policy in such countries have consistently been used in a supportive manner in a long-term programme of sustainable development.

The requirements of the modern learning economy, as the foundation for the successful evolution of the system of innovation, include a shift in policy focus away from the standard macroeconomic policy

tools. The focus has to move to those areas of policy that directly affect the conditions of the institutional context in which human and social capital growth can be secured. In this sense, distribution issues and sustainable programmes of poverty alleviation assume a high level of priority in the ranking of policy tools.

2.7 Economic sectors and priorities

One of the earliest debates in development economics concerned the priorities assigned to economic sectors in investment allocation and the application of stimulus packages. The debate related essentially to the two camps of balanced and unbalanced growth approaches to the 'big push' theory of economic development (see Rosenstein-Rodan, 1943 and Hirschman, 1958). While both sides of the debate agreed that an incremental policy was unlikely to lift underdeveloped economies out of low-level equilibrium poverty traps, their proposals for the deployment of resources to implement the 'big push' were diametrically opposed.

The balanced growth proponents focused on the interdependence of sectors, especially in terms of consumption power, within a closed-economy framework. Those who advocated the unbalanced approach departed from the assumption of limited resources, not least of which was decision-making capabilities, or Hirschman's 'ability to invest' (Hirschman, 1958), and advocated the 'big push on a narrow front' with priorities assigned on the basis of industrial linkages, and potential spillover and multiplier effects. This early approach to the prioritisation of state intervention has been refined to reflect the increasing rapidity of techno-economic paradigm shifts, which make it increasingly difficult to predict future states on the basis of current ones. Moreover, there is growing realisation that over-reliance on existing inter-industry linkages, which has led to the increasing popularity of cluster analysis, may sometimes lock economies into the industrial development paths that reproduce current structures. Often what is needed when assigning development priorities is an exercise in 'imagining the future', as exemplified in foresight planning.

2.8 Attainment of the Millennium Development Goals

From an innovation system approach, the Millennium Development Goals (MDGs) are a mix of development goals and instruments, and it would be useful to couch them as part of the array of development instruments. There is, however, scope for an elaboration of the possible inter-linkages among the eight MDG sets, possible sequencing chains, and the strata of the national system of innovation with which they are most likely to engage.

From a system of innovation perspective, the first of the eight MDGs (to eliminate poverty and hunger) can be seen as the overriding objective, with most of the others as policy instruments. Thus, education, gender equality and the three goals referring to various aspects of health can be considered essential prerequisites for the development of a sustainable human capital base on which a viable innovation system can be built. The goal referring to global partnerships relates to aspects of the globally integrated economy that can be brought to bear to ease some of the crippling constraints of the global economic order on the development of poor economies. Social or network capital is also an issue here in addition

to the development of human capital. Finally, the goal on environmental sustainability reflects the increasing concern of the world economy over the need to decouple economic growth and development from environmental degradation. This goal does not have a direct effect on the development prospects for poor nations, but may even, from several perspectives, be regarded as a constraint. Alternatively, addressing the environmental implications of industrialisation offers a strong incentive for the development of appropriate technologies, thereby enhancing local systems of innovation.

The progress chart for selected MDG targets in Northern Africa and sub-Saharan Africa is depicted in Table 2.5.

Table 2.5: Progress chart for Africa towards the Millennium Development Goals: Selected targets and indicators (2009)

Goal	Objective	Indicators/Targets for 2015	Northern Africa	Sub-Saharan Africa
1	Eradicate extreme poverty and hunger	Reduce extreme poverty by half	Low poverty	Very high poverty
		Productive and decent employment	Very large deficit in decent work	Very large deficit in decent work
		Reduce hunger by half	Close to target	Very high hunger
2	Achieve universal primary education	Universal primary schooling	High enrolment	Low enrolment
		Equal girls' enrolment in primary school	Close to parity	Close to parity
3	Promote gender equality and empower women	Women's share of paid employment	Low share	Low share
		Women equally represented in national parliaments	Very low representation	Low representation
4	Reduce child mortality	Reduce mortality of under five-year-olds by two thirds	Low mortality	Very high mortality
5	Improve maternal health	Measles immunisation	High immunisation	Moderate coverage
		Reduce maternal mortality by three quarters*	Moderate mortality	Very high mortality
6	Combat HIV/AIDS, malaria and other diseases	Access to reproductive health	Moderate access	Low access
		Halt and reverse spread of HIV/AIDS	Low prevalence	High prevalence
7	Ensure environmental sustainability	Halt and reverse spread of tuberculosis	Low mortality	High mortality
		Reverse loss of forests	Low forest cover	Medium forest cover
		Halve proportion without improved drinking water	High coverage	Low coverage
8	Develop a global partnership for development	Halve proportion without sanitation	Moderate coverage	Very low coverage
		Improve lives of slum dwellers	Moderate proportion of slum dwellers	Very high proportion of slum dwellers
		Internet users	Moderate usage	Very low usage

Notes: Sources: Derived from ECA, AUC & AIDG (2009) and Statistics Division, Department of Economic and Social Affairs, United Nations. The words in each box indicate the present degree of compliance with the target. The colours show progress towards the target according to the legend:

Already met the target or very close to meeting the target
 Progress sufficient to reach the target if prevailing trends persist
 Progress insufficient to reach the target if prevailing trends persist
 No progress, or deterioration

* The available data for maternal mortality do not allow a trend analysis. Progress in the chart has been assessed by the responsible agencies on the basis of proxy indicators.

The trends in the movement of selected variables towards the specified MDGs, as shown in Table 2.5, highlight two immediate points. The first is that in terms of dynamics, the two regions of Northern Africa and sub-Saharan Africa are markedly different, to the extent that structural differences in the base of the national systems of innovation between the two regions may be deduced. There is a historical rationale for the treatment of the two regions as separate and distinct, related to the nature of their colonisation and the ensuing post-colonial states. The colonisation of Northern Africa was primarily driven by the strategic imperatives of the various colonial powers. That of sub-Saharan Africa was motivated more by the resource requirements of the empires. This possible structural difference poses a serious challenge to an effective programme of regional integration across the African continent. At the same time, however, if systematically addressed, it also offers the possibility of increasing the complementarities of systems of innovation across the continent.

The second point is that the current trends indicate that sub-Saharan Africa will not achieve any of the MDGs along the current trajectory paths for reasons that relate to some extent also to the differences in the colonial histories of the two African regions. In a dynamic world, this implies an ever-growing gap between sub-Saharan Africa and the rest of the world. The linkages between a sound STI policy and the attainment of the MDGs are quite evident, especially if the definition of STI is extended to the institutional and technological domains. The attainment of most of the MDGs requires innovation at the technological level; it also requires innovation on the institutional front in education, health and international partnerships. It is obvious that these innovations, especially at the institutional level, have to be radical, given the current deficit of the existing development trajectories with respect to the MDGs.

2.9 Global competitiveness

In the era of unprecedented global liberalisation of trade, investment, human capital and knowledge flows, the drive for nations to be globally competitive has novel implications for the evolution of national systems of innovation. Prior to the current globally integrated economic regime, the typical successful development path was generally based on the policy prescriptions of List's (1848) infant industry model. The successful adoption of this policy accounted for the emergence of the Asian Tigers and the newly industrialised economies in the 1970s. The sheer size and economic power of the Chinese economy and its steady process of reform since the late 1970s is a specific case of development on the basis of local competence-building as the platform for global competitiveness. The case of India provides a similar example of the emergence of a globally competitive giant with the liberalisation of the economy since the 1990s, preceded by a long period of protected inward industrialisation. The Indian case is especially interesting because of its implications for the potential to develop technological capabilities, core competencies and competitive advantages on the basis of the internal market.

This option is now closed for most African economies. Their poorly developed industrial base, small populations with limited purchasing power and an impoverished reproductive base for human capital development strongly militate against their chances of developing sufficient local competence in the free trade era. Individually, the internal economies of most African economies are far too small and their institutions too poorly developed and unstable to offer much hope for development. If, however, we look at the continent as a whole from an innovation systems perspective, possibilities for escaping the poverty

trap arise, in spite of the formidable political and institutional obstacles to viable integration. This is a case where the necessary overrides the improbable, as argued by Muchie *et al.* (2003).

2.10 Industrialisation and entrepreneurship

The issue of entrepreneurship and its relationship to the industrialisation process has occupied the attention of development planners, but the lack of debate on the meaning of the concept and an understanding of its role in the evolution of systems of innovation is often the source of grave mistakes in policy-making. Entrepreneurship has been one of the main areas of focus of the debates on growth and development strategies, which have often assumed certain market conditions that have not always been supported by evidence. Often, this excessive focus on entrepreneurship is used in the drive for the development of the small, medium and micro enterprise (SMME) sector and even of the informal sector as the panacea for countries' development problems. Such an approach can be quite dangerous, and we need to unpack the various shades of meaning of this term and the role of this factor in industrialisation and development.

In the first place, the term 'entrepreneurship' is often used synonymously with the enterprising and innovative qualities, whether actual or latent, of virtually all human beings. When linked with the neoliberal formulation of human capital, an all-embracing definition of entrepreneurship is brought into service in advocating the predominance of individual over public responsibility in the economic growth and development process.

Innovation does indeed happen within enterprises and is the outcome of entrepreneurial activity, but the foundation for the translation of entrepreneurship into innovation and sustainable industrialisation lies in the existence of a broad base of highly skilled, enterprising, but risk-averting employees (see Coase, 1937). Given this prerequisite, history, including very recent history, has also taught us that the translation of entrepreneurship into general welfare also requires a comprehensive and effectively enforced regulatory framework supporting human resource development and value creation.

Africa does not lack entrepreneurs or individual enterprise. Of course, most of those who behave as entrepreneurs do so because of the lack of alternatives, forced by economic circumstances, political instabilities and general institutional failure. It is not so much entrepreneurship that needs to be promoted in sub-Saharan Africa as the solid institutional foundation within which entrepreneurship can be leveraged to stimulate the type of industrialisation process required for structural transformation and development.

2.11 Regional integration

Given the history of Africa, the specificities of sub-Saharan Africa, and the congruence of factors which, in the post-colonial period, now render most autonomous national systems of innovation non-viable, there is a need to reflect more deeply on the possible benefits of integrating African economies on a systemic basis. From an innovation systems approach, this implies the need to transform the region from a set of disparate national systems of innovation into a continental (or at least sub-continental) agglomeration. The first stage of this transformation requires the mobility of people and resources, as

well as information across current national borders. Beyond this, however, a sustainable continental system of innovation requires the integration of the particular national legal frameworks in sectors such as finance, labour, industry and the environment.

Article 1 of the African Economic Community Treaty of 1991 recognises the importance of regional integration in order to increase economic self-reliance and promote endogenous, self-sustainable development of the African continent. This is complemented by Article 51, which urges institutions to strengthen their capabilities and cooperation in order to use science and technology to improve the quality of life of the citizens of their countries (OAU, 1991). These processes, if applied appropriately, are essential for a more functional system of innovation. The essence of this Treaty has been captured in sub-regional and continental agreements. The African Union (AU) Strategic Plan 2010–2012 is aimed at strengthening continental integration through measures such as the harmonisation of the regional economic communities and free movement of people, goods, capital and service (AUC, 2009).

The current strategic transition from the NEPAD (New Partnership for Africa's Development) Secretariat to the NEPAD Agency has brought about a revised *modus operandi* whereby sectoral approaches have been enhanced by programmatic and results-based management. While the NEPAD-identified sectors⁵ have remained unchanged, the new approach requires the Agency to ensure delivery in a more integrated manner on five themes⁶ linked to the four pillars of the AU Strategic Plan (AU/NCPA, 2010).

NEPAD's new approach is well aligned with the MDGs and establishes a sound foundation for the development of regional systems of innovation, which are now recognised as essential to enabling structural transformation and economic development. It also poses challenges to all continental institutions to translate policy directives into meaningful programmes with positive outcomes.

Equally important has been the recognition of the role of science and technology in the context of regional economic integration. This has been spelt out in the SADC Science and Technology Protocol (SADC, 2008), by the Commission of the Economic Community of West African States responsible for Human Development and Gender (ECOWAS, 2007) and in the Treaty for the Establishment of the East African Community (EAC, 2007), among other initiatives. Much work has still to be done in creating and capacitating these bodies, which are the essential building blocks of the African Union.

Notwithstanding these initial efforts towards regional integration, most of the African economies remain largely resource-based. In the current geopolitics of world trade, most African countries export their natural resources to the more industrialised world with minimal value-added content, while simultaneously importing capital goods and consumer products. This inequitable scenario does not enhance the prospects for regionally integrated systems of innovation. It is of paramount importance that better intra-system flows of trade, investment and, more especially, technological upgrading must serve to benefit all participants. This virtuous cycle becomes possible through improvements in the generation, adoption, diffusion and contextually relevant transformation of knowledge to meet local demands and address domestic challenges. The breaking of this particular development trajectory rests crucially on effective strategy to integrate the systems of innovation across Africa. We have already seen the marked differences in economic performance between Northern Africa and sub-Saharan Africa. These differences offer the possibility of enlarging the internal trading and investment base of the eventual continental system of innovation.

The issues of scope and scale on both the supply and the demand sides of the system of innovation within Africa suggest that the various national systems of innovation on the continent should move as

rapidly as possible to an integrated continental system of innovation. This is an area for further research in subsequent phases of the ASTII initiative.

The arguments in this chapter support the development of Africa's continental system of innovation as a feasible, long-term strategy to attain a sustainable dynamic of development. In this context, improving the functioning of national systems of innovation should serve to radically enhance human capabilities and improve production processes. Regional integration offers the prospect of quantitatively expanding competencies towards the continental system of innovation through policy experimentation and learning by doing.

2.12 Conclusions

Africa, in 2010, is host to a significant share of the world's human population. In the millennia since Africa acted as the cradle of humanity, the continent has suffered through protracted periods of dependence and underdevelopment. While the yoke of colonial and imperial subjugation has largely been overcome, contemporary Africa remains divided into 54 sovereign national entities. It is home to the largest number of least-developed countries and, while certain of the Millennium Development Goals will be achieved, over half its population struggles to survive in conditions of abject poverty. However, the sustained growth over the last decade and a half has started to generate positive outcomes for the continent.

Structural impediments such as low levels of infrastructure, adverse economic participation rates and the lack of regional economic integration remain worrying features of the current growth trajectory. Moreover, the continued external demand for commodities tends to reinforce distorted markets. Unless deliberate efforts are made to encourage and expand endogenous economic growth by improving the framework conditions for innovation, Africa may not be able to harvest the potential of the demographic boom represented by its young population. Approaching the relationship of economic development from the systems of innovation perspective accentuates the critical role of institutions and human capabilities as drivers of change.

Improving institutions, so that they become broadly participative, transparent and universal, is imperative in redressing the failures of the past and ending the inevitable continuities with path dependencies. This chapter has argued in favour of a form of structural transformation that has, at its core, the progressive dynamics of Schumpeter's creative destruction. This necessitates the stimulation of technological progress, the improvement of human capabilities and the promotion of framework conditions that support the entry and exit of activities. Given the appropriate institutional context, entrepreneurship at all scales (in micro, small, medium and large enterprises) has the potential to meet the huge demands of the continent and its population of over one billion. Legitimate, participative governance, strengthened through an innovation systems policy perspective, will also improve social cohesion by reducing uncertainties and enabling evolutionary change. In combination, these discrete components of policy-making and coordination offer the continent the opportunity to escape the vicious cycles of underdevelopment.

- ⁵ The sectors identified by NEPAD are agriculture and food security; environment and tourism; infrastructure (transport, water and sanitation; energy; and information and communication technologies (ICT)); education and health; trade, market access, investment and private sector; science and technology; governance; and gender, youth and civil society.
- ⁶ The NEPAD Agency must deliver its programmes according to the following five themes: Food Security; Climate Change and Sustainable Development; Regional Integration and Infrastructure; Human Capital Development; and Economic and Corporate Governance.

References

- AfDB (African Development Bank) (AfDB) (2010), *African Statistical Yearbook*, AfDB, African Development Bank, Tunis.
- Ashford, Lori S. (2007), *Africa's Youthful Population: Risk or Opportunity?*, Population Reference Bureau, Washington DC.
- AU (African Union)/NCPA NEPAD (New Partnership for Africa's Development Planning and Coordinating Agency) (2010), NCPA Strategic Direction 2010-2013, www.nepad.org/system/files/NPCA/, accessed 26 January 2010.
- AUC (African Union Commission) (2009), African Union Strategic Plan 2009-2012, www.africa-union.org/root/AU/AboutAU/strategic_Plan_2009-2012/, accessed 26 January 2011.
- Blankley, William, M. Scerri, N. Moloja and I. Saloojee (Eds) (2006), *Measuring Innovation in OECD and non-OECD Countries*, Human Sciences Research Council, Tshwane.
- Bowles, Sam and H. Gintis (1975), "The Problem with Human Capital: A Marxian Critique", *American Economic Review*, 65, pp. 74-82.
- Cassiolato, Jose E., H.M.M. Lastres and M.L. Maciel (2003), *Systems of Innovation and Development: Evidence from Brazil*, Edward Elgar, Cheltenham.
- Coase, Ronald H. (1937), "The Nature of the Firm", *Economica*, Vol. 4, pp. 386-405.
- Dosi, Giovanni, C. Freeman, R. Nelson, G. Silverberg and L. Soete (Eds) (1988), *Technological Change and Economic Theory*, Pinter, London.
- EAC (East African Community) (2007), "East African Community Treaty for the Establishment of the East African Community", www.eac.int/treaty/, accessed 25 January 2011.
- ECA (United Nations Economic Commission for Africa) (2009), "Developments in Intra-African Trade", ECA, United Nations Economic Commission for Africa, Addis Ababa.
- ECA, AUC (African Union Commission) and AfDB (2009), "Assessing Progress in Africa toward the Millennium Development Goals", ECA, AUC and AfDB, Phoenix Design Aid A/S, Copenhagen.

- ECOWAS (Economic Community of West African States) (2007), "Education, Culture, Science and Technology Department", Office of the Commissioner Human Development and Gender, ECOWAS, www.comm.ecowas.int/dept/stand/, accessed 25 January 2011.
- Freeman, Christopher (1987), *Technology Policy and Economics Performance: Lessons from Japan*, Pinter, London.
- Freeman, Christopher (1993), "The 'National System of Innovation' in Historical Perspective", *Cambridge Journal of Economics*, Vol. 19, No. 1, pp. 5-24.
- Freeman, Christopher and Carlota Perez (1988), "Structural Crises of Adjustment, Business Cycles and Investment Behaviour", in Dosi et al. (Eds), *Technological Change and Economic Theory*, Pinter, London.
- Hirschman, Albert O. (1958), *The Strategy of Economic Development*, Yale University Press, New Haven, CT.
- Leke, Acha, S. Lund, C. Roxburgh and A. van Wamelen (2010), "What's Driving Africa's Growth", *The McKinsey Quarterly*, June, McKinsey and Company, New York.
- List, Friedrich (1848, reprinted 2005), *National System of Political Economy*, Vols. I-III, Cosimo, New York.
- Lundvall, Bengt-Åke (Ed.) (1992), *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, Pinter, London.
- Maharajah, Rasigan (2008), "Global Economic Policy Reform", in Michelle Pressend and M. Ruiters (Eds), *Dilemmas of Poverty and Development*, Institute for Global Dialogue, Midrand.
- McKinsey Global Institute Analysis (2010), *Lions on the Move: The Progress and Potential of African Economies*, McKinsey Global Institute, Washington DC.
- Muchie, Mammo (2003), "Rethinking Africa's Development through the National Innovation System", in M. Muchie, B-Å. Lundvall and P. Gammeltoft (Eds) (2003), *Putting Africa First: The Making of African Innovation Systems*, Aalborg University Press, Aalborg.
- Muchie, Mammo, Bengt-Åke Lundvall and Peter Gammeltoft (Eds) (2003), *Putting Africa First: The Making of African Innovation Systems*, Aalborg University Press, Aalborg.
- Nelson, Richard R. 1993. *National Innovation Systems: A Comparative Analysis*, Oxford University Press, New York.
- Nelson, Richard R. and Sidney G. Winter (1982), *An Evolutionary Theory of Economic Change*, Harvard University Press, Boston.
- OAU (Organisation for African Unity) (1991), "Treaty Establishing the African Economic Community", http://www.africa-union.org/root/au/Documents/Treaties/Text/AEC_Treaty_1991.pdf, accessed 26 January 2011.
- OECD (Organisation for Economic Cooperation and Development) (1992), *Oslo Manual: OECD Proposed Guidelines for Collecting and Interpreting Technological Innovation Data*, OECD, Paris.
- OECD (1997), *National Innovation Systems*, OECD, Paris.
- OECD (2002), *Frascati Manual: Proposed Standard Practice for Surveys on Research and Development*, OECD, Paris.
- OECD/Eurostat (1997), *Proposed Guidelines for Collecting and Interpreting Technological Innovation Data, Oslo Manual*, OECD, Paris.

- OECD/Eurostat (2005), *Oslo Manual, Guidelines for Collecting and Interpreting Innovation Data*, OECD, Paris.
- Page, S. and D. Te Velde (2004), "Foreign Direct Investment by African Countries", draft paper prepared for InWent (Internationale Weiterbildung und Entwicklung)/ UNCTAD (United Nations Conference on Trade and Development) meeting on FDI in Africa, 22-24 November, ECA, Addis Ababa.
- Perez, Carlota (2009), "Technological Revolutions and Techno-economic Paradigms", *Cambridge Journal of Economics*, Vol. 34, No. 1, pp. 185-202.
- Rosenstein-Rodan, P. (1943), "Problems of Industrialization of Eastern and South-Eastern Europe", *Economic Journal*, Vol. 53, No. 210/211, pp. 202-211.
- SADC (Southern African Development Community) (2008), "Final Communiqué of the 28th Summit of SADC Heads of State and Government", SADC, August 2008, www.sadc.int/fta/index/browse/page/203, accessed 25 January 2011.
- Scerri, Mario (2003), "The Prospects for Regional Innovation System(s) within Sub-Saharan Africa", in M. Muchie, B-Å. Lundvall and P. Gammeltoft (Eds) (2003), *Putting Africa First: The Making of African Innovation Systems*, Aalborg University Press, Aalborg.
- Sen, Amartya (1999), *Development as Freedom*, Anchor Books, USA.
- Solow, Robert M. (1956), "A Contribution to the Theory of Economic Growth", *Quarterly Journal of Economics*, Vol. 70, pp. 65-94.
- UNDP (United Nations Development Programme) (2010), *Human Development Report 2009*, UNDP, New York.

Annex A: Human Development Index

High human development				Low human development			
Rank	Country	HDI	World rank	Rank	Country	HDI	World rank
1	Libya	0.847	55	30	Togo	0.499	159
2	Seychelles	0.845	57	31	Malawi	0.493	160
3	Mauritius	0.804	82	32	Benin	0.492	161
Medium human development				33	Côte d'Ivoire	0.484	163
Rank	Country	HDI	World rank	34	Zambia	0.481	164
4	Tunisia	0.769	98	35	Eritrea	0.472	165
5	Gabon	0.755	103	36	Senegal	0.464	166
6	Algeria	0.754	104	37	Rwanda	0.460	167
7	Equatorial Guinea	0.719	118	38	Gambia	0.456	168
8	Cape Verde	0.708	121	39	Liberia	0.442	169
9	Egypt	0.703	123	40	Guinea	0.435	170
10	Botswana	0.694	125	41	Ethiopia	0.414	171
11	Namibia	0.686	128	42	Mozambique	0.402	172
12	South Africa	0.683	129	43	Guinea-Bissau	0.396	173
13	Morocco	0.654	130	44	Burundi	0.394	174
14	São Tomé and Príncipe	0.651	131	45	Chad	0.392	175
15	Republic of the Congo	0.601	136	46	Democratic Republic of the Congo	0.389	176
16	Comoros	0.576	139	47	Burkina Faso	0.389	177
17	Swaziland	0.572	142	48	Mali	0.371	178
18	Angola	0.564	143	49	Central African Republic	0.369	179
19	Madagascar	0.543	146	50	Sierra Leone	0.365	180
20	Kenya	0.541	147	51	Niger	0.340	182
21	Sudan	0.531	150	Unavailable data			
22	Tanzania	0.530	151	Somalia			
23	Ghana	0.526	152	Zimbabwe			
24	Cameroon	0.523	153				
25	Mauntania	0.520	154				
26	Djibouti	0.520	155				
27	Lesotho	0.514	156				
28	Uganda	0.514	157				
29	Nigeria	0.511	158				

Source: UNDP (2009)