Knowledge for development in the African region: a critical review

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Abstract: Sustainable development in Africa requires the modernisation of the knowledge base. Indeed, modern scientific and technical knowledge has become the chief currency of present-day times and a decisive resource for sustainability and progress. This chapter reflects on the concept and power of knowledge and discusses the current state of knowledge in Africa, as it relates to the radical transformations that are necessary to achieve a meaningful transition to sustainable development. This transition is far from being on track for at least half of the region and it desperately needs a boost from scientific and technological knowledge. In fact, the region may be losing the global knowledge race that characterises the development effort at the beginning of this 'knowledge millennium'. Various types of knowledge are considered and assessed and critical knowledge challenges are formulated. The role of scientific and technical knowledge is particularly emphasised as the main driver of sustainable development and the contribution of indigenous and mythological knowledge is also stressed. In conclusion, the paper calls for the initiation of self-exorcism and a profound reform of knowledge based on the premise that freedom is the infinite fountain of knowledge.

1 Introduction

This chapter is a reflection on African knowledge, African Knowledge Economies (AKEs), African Knowledge Societies (AKSs) and African knowledge policies for sustainable development. Its purposes are to contribute to sustainable development thinking in the African region and open a new front in the development discourse. During the last decade, many excellent initiatives have emerged in knowledge dissemination, partnerships, networking, sharing and access mainly through Information and Communications Technologies (ICTs), especially the internet – the emerging mega-bazaar of knowledge. These initiatives are important and strategic for sustainable development and are amongst the best things to take place in Africa for a long time. Other complementary initiatives may be necessary for the majority of Africans who do not use ICTs for learning, researching, communicating, accessing, sharing or partnering. It is these Africans, particularly the distressed ones, who struggle with the lack of knowledge and technology, fail to meet their basic needs and are in dire need of sustainable livelihood. This paper is an attempt to provide insight into the root causes of their difficulties to meet their basic needs. A better understanding of these causes is a prerequisite for sound policy formulation.

The chapter is divided into nine sections. Section 2 discusses the hypercomplex concepts of knowledge and sustainable development. It provides new ways to appreciate and evaluate knowledge as it relates to sustainable development. It discusses the essence, core, mainstays and ideology of sustainable development in Africa. The relation of mythological knowledge with the environment (economic-social) is explored and its impacts assessed. Some ideas are put forward on the power of knowledge creation, a metaparadigm of sustainable development, the complementary approaches to knowledge assessment and the nature of knowledge in AKSs. Section 3 deals with the issues related to knowledge evolution and the long-drawn-out, makeshift and wavering transition for meeting the Millennium Development Goals (MDGs) and realising sustainable development. It emphasises the crucial role of scientific, technological and technical knowledge for the acceleration of this transition. Section 4 discusses the issues related to knowledge innovation and globalisation. It formulates some ideas on AKEs, emerging opportunities, the need to compete internationally, the global knowledge race and the emerging knowledge megawave. It reflects on the lopsided globalisation of knowledge, knowledge competition and the globalisation of sustainable development in an unequal and unjust world.

Section 5 discusses the issues related to the integration of compartmented layers of knowledge and knowledge ghettos and their integration through knowledge institutions, associations, academies, forums, portals, media, networks and centres. Section 6 deals with the issues related to knowledge constellation, clustering, linkages and packaging, including a knowledge package to achieve the African Green Revolution (AGR) – a scientific and technological achievement and a *sine qua non* condition of sustainable development. It underlines the need to embrace promising modern scientific and technical knowledge and upgrade traditional knowledge. Mythological knowledge, particularly evangelical and *qur'anic* knowledge, which plays a dominant role in somewhat mesmerising and domesticating African societies, are discussed in Section 7. The values underpinning this knowledge are analysed in relation to their contribution (or noncontribution) to sustainable development. It argues for the need to demythologise/ remythologise common, ordinary and trivial knowledge. This calls for a de-deification, demystification, deprophetisation and desacralisation of African knowledge, as well as the necessity to evolve a scientific culture. Section 8 explores other fundamental determinants of sustainable development and new avenues for knowledge emancipation and liberation that can power sustainable development. Various policy directions regarding all types of 'soft' or 'gaseous' knowledge are suggested. Section 9 concludes on the special role and responsibility of knowledge elites, leaders and lovers in bringing about a culture of freedom and enabling environments for revolutionary changes. It outlines the policy initiatives and knowledge futures and horizons that can help bring about the drastic transformations necessary to achieve a meaningful transition to sustainable development in Africa.

2 Knowledge appreciation and evaluation

2.1 Concepts of knowledge for sustainable development (knowledge conceptualisation)

Knowledge is the product of bio-anthropo-socio-cultural interactions. It co-produces perceived and conceived reality. It wrestles with doubt, disorder, uncertainty, hazard, irregularity, error, redundancy, illusion, self-justification and self-deception. It is a phantom concept, an enigma concept and a pilot concept. True knowledge is improvable within the linguistic or logic system in which it is produced (Larski and Godel theorems). Absolute knowledge requires infinite information and infinite energy. It is a fundamental concept, but it is more Shakespearian than Newtonian. Knowledge, for example, can be viewed as an economic, social, cultural,[1] biological, political (Cohen and Burying, 1992), philosophical[2] and historical concept. It can be seen as a resource (World Development Report, 1998), a tool, an asset (Winter, 1987), a product (Mokyr, 2002), a factor of production (Arrow, 1971), a currency (Laporte, 2003), a competitive advantage (Boisot, 1998), a value (Krogh *et al*., 2000b), a system (international and local), a wellspring (Leonard, 1995), a servant, a master and a weapon (Annan, 2005).[3] It can be seen as a mediator, a translator, an organiser and a constructor of reality. It can be seen as the capacity, power and enlarger of the domain of human destinies. A diversity of knowledge is favourable to its progress. It has the potential to realise the full plasticity of human societies and a range of possible futures. But because of its often fragmented, fractured, dismembered, atomised, localised, specialised, mutilated, dispersed, value-free (scientific) and decontextualised character, it can be untapped, unused, misused, misapplied, misinterpreted or misappropriated. Modern knowledge can be an equaliser of cultures open to knowledge and a homogenising force in history. It can be a springboard to development and can also be destructive of cultural diversities. It is somewhat autonomous, selective (Plotkin, 1994), emerging, blind, fluid, transitory (Nonaka and Nishiguchi, 2001) and evolutionary (Popper, 1979). It is also relative, subjective, possessive and authoritative. It is at the heart of multiple emancipation, liberation, progression, maturation and development processes, which are often involuntary or unplanned (the internet and modernity were not designed as projects, but are the result of zillions of ultracomplex knowledge interactions). Knowledge advances power sustainable development.

2.2 A knowledge-based paradigm for sustainable development (knowledge ecologisation)

All knowledge, including socio-environmental, is ecological and the growth of knowledge throughout history gave rise to a super eco-organ: the brain. All knowledge is also mythological: mythologies provide the substance, glue, meaning, purpose and organisation of thinking and society. Effective ideo-mythological and techno-scientific knowledge is the dual engine that propels sustainable development. This engine is fuelled by enabling nontechnical knowledge environments (the mytho-environment), on the one hand, and efficient technical and technological knowledge environments (the techno-environment), on the other hand. At the core level, sustainable development in Africa requires effective mytho-techno-scientific knowledge for sound environmental management and the rehabilitation of the resource base, economic growth and poverty

reduction, the realisation of an AGR and food security and improved prospects for the young generation. These are the critical mainstays of sustainable livelihoods, incorporating vital elements of the Johannesburg Plan of Implementation (JPOI) and key targets of the MDGs – in themselves a workable vision, albeit mutilated, of sustainable development in the African context.

2.3 A knowledge-based metaparadigm for sustainable development (knowledge paradigmisation)

At the supralevel, self-confirming faith-based ancient and medieval knowledge systems facilitate or hinder sustainable development in many ways and could give way to a metaparadigm of 'sustainability' that incorporates vital scientific and technical knowledge for a new world knowledge order. This metaparadigm could emerge in interaction with and in conjunction with/opposition to other powerful paradigms influencing sustainable development. These include hygienism (HIV), regionalism (integration), messianism, christianism, islamism, animism, mysticism, shamanism, charlatanism, modernism, environmentalism, naturalism, democracism, tribalism, ethnocism, socialism, capitalism, liberalism, scientism, technologism (biology, ICTs), pacifism, consumerism (Genetically Modified Organisms), universalism (UN), feminism, humanism (human rights/genocide), nationalism, independentism (movements in many African countries) and globalism. Globalism, for instance, could be pursued within the framework of a more equal, just, fraternal, cohesive, eco-responsible and sustainable world society, with world identity, world citizenship and knowledge rights (a distant reality). Such a society would require a reconceptualisation of knowledge for development, including its concentration (centric, uncentric, polycentric), hierarchisation (hierarchic, unhierarchic, polyhierarchic) and distribution (competence, polycompetence, specialisation). There is a need to evolve a metaparadigm of sustainability, coherent with a mythological sustainable world society, and investigate how various types and structures of knowledge can better contribute to its realisation.

2.4 Knowledge as a sustainable resource (knowledge sustainability)

A perspective of knowledge as a sustainable resource for development has not been formulated yet. In the final analysis, knowledge is an intimate communion with the essence of reality and a capacity to transform this reality for development. In this perspective, efficient knowledge is required to grasp and change reality. It is required for natural environments to be conserved, protected and rehabilitated. It is required for constructed electronic, institutional, social, economic, cultural and political environments and for facilitating the circulation and use of this knowledge. Political environments require full universal access to relevant knowledge for making sound political choices and meaningful, participative and democratic governance. Cultural environments require the full utilisation of all talents and available knowledge and a diversity of knowledge. Economic environments require full access to knowledge to make rational economic choices. These environments must be organised according to the principles of sustainability, which can become the central organising principles of AKSs. This means organising development knowledge, as much as possible, as an inherited universal and accessible public good (Dalrymple, 2003). This is the challenge of the sustainability of

knowledge for sustainable development. Meeting this challenge will contribute to social justice and equal opportunity in the access and use of knowledge. Unrestricted and fair access to development knowledge is a principle coherent with knowledge as a common human heritage and the property of humanity (Kahle, 2004). At least three kinds of knowledge should be made freely accessible: humanitarian or assisting, royalty-free and tax-funded. The African Agricultural Technology Foundation, for instance, is dedicated to identifying and facilitating the royalty-free acquisition of proprietary knowledge and technologies through negotiation and entering into contractual agreements with existing institutions that will manage the deployment of the technologies and the related technical knowledge. Protected and private knowledge is a momentary and transitory phenomenon and an exception to the rule. The sustainability of knowledge has to be a concern, since knowledge can be monopolised, controlled, altered, sullied, devalued, misused, corrupted and ruined in many ways. Knowledge embodied in peoples is biodegradable, may be easily lost and may lead to intergenerational discontinuities and development failures. Knowledge embedded in institutions may be contaminated, altered, distorted, misused, misplaced, stolen, *etc.*; knowledge incorporated in culture may vanish. The sustainability of knowledge is an important challenge.

2.5 Complementary approaches to knowledge evaluation (knowledge investigation)

Knowledge relevant to sustainable development has to be better investigated. This can be done from many angles: scientific, philosophical, humanistic, sociological. As an object of scientific discourse, scienticism provides a body of principles – postulates, axioms, theorems, laws – and methods – corrosion of doubt, competition, criticism, verification, refutation – that were developed during the last 500 years. Physics provides insight into knowledge as negentropy. Biologism reveals the ecological nature of knowledge (knowledge as an ecolibrary), processed from information gathered though perceptors, sensors and extractors. It provides insight into knowledge as a capital of eco-information that is computed and which involves proteino-electrochemical reactions. Cybernetics offers useful concepts related to knowledge programming, communication and processing (expert knowledge system). Systemism analyses knowledge as systems of ideas and provides rich theoretical concepts. Psychologism uncovers the irrational pulsations, sentiments and behaviours underlying knowledge and their associated knowledge pathologies (fixation, hysteria, hallucination, schizophrenia, *etc.*). As an object of philosophical discourse, rationalism proposes that knowledge stems from reason and logic (*true* knowledge), idealism holds that knowledge is an artifice or a construction of the mind, empiricism believes that all knowledge comes from experience or practices, mysticism claims that knowledge is derived from the divine, foundationalism claims that knowledge statements require justification of the foundation of the knowledge system, coherentism holds that a knowledge statement is justified if it is coherent with all other knowledge claims and nihilism claims that there cannot be any fundamental justification for knowledge statements. As an object of humanist discourse, humanism provides a set of freedoms and benchmarks related to knowledge expression, such as those found in human rights charters, constitutions and legislations. As an object of sociological discourse, social determinism claims that all knowledge is socially determined through

language, education and culture. All these approaches and others can be useful for the investigation of knowledge in relation to sustainable development. They can help assess its current state in the African region.

2.6 The nature of African knowledge environments (knowledge representation)

The assessment of the state of knowledge in the African region necessitates a good understanding of the nature, foundations, structures and characteristics of AKSs – a concept that is not limited to advanced societies and goes beyond prolonging the information or digital society (Barka, 2004). This is necessary for designing new policy initiatives. It is necessary for formulating relevant policy issues and directions, upgrading anachronistic knowledge bases and accelerating the transition from largely pre-modern, knowledge-deficient, unsustainable AKSs to rapidly progressing or modernising ones. In Africa, there are many indigenous writing systems,[4] but a large proportion of knowledge is not written, documented, formalised, standardised or certified – let alone patented or protected – but expressed and communicated through other means. In fact, African knowledge is profoundly dependent on signs, symbols,[5] myths and magic.[6] These permeate beliefs, arts, rock paintings,[7] clothes, songs, ceremonial objects, decorative drawings, tattoos, rites, masks, figures,[8] architecture, legends, fables, metaphors and proverbs (Dzobo, 1992).[9] This knowledge is extraordinarily rich but not very effective for modern development, which requires more precise, definite, utilitarian, tradable and codified 'hard' scientific and technical knowledge. The relative lack of written indigenous knowledge has been a major handicap to sustainable development in Africa. As AKSs function in hundreds of different languages, appropriate linguistic policies are also needed to share and benefit from knowledge advances, especially in an era where more than half of all web pages are in English and very few are in indigenous languages, which may eventually lead to a loss of cultural diversity and a loss for humanity (and perhaps a gain in mass communication and modernisation/westernisation).

2.7 Impacts of mythological knowledge on the environment (knowledge problematisation)

Amongst indigenous knowledge, mythological knowledge determines lifelong beliefs and lifestyles and is often linked to the spirit of the dead (panvitalism) through temple-less ancestors worshiping and reverence for ancestors' sacred places. All of these are closely associated with the world of death, after-death and the spirits and closely associated to the environment through the preservation of ancestral land. Many Africans organise their lives by following the guiding beliefs and principles of animist or similar knowledge. This keeps them close to the environment, with the environment, inside the environment, fitting in the environment and respectful of its providence (and its spirits). They tend to adapt to the environment and adopt the environment. For them, the natural environment is god. On the other hand, the evangelisation and islamisation of knowledge, which influence the lives of a majority of Africans, impact and transform the environment and its sustainability in many subtle ways. At the fundamental level, many Africans, particularly those in difficulty, may have surrendered their fates, fortunes and development prospects to a mythical 'higher power' and may see themselves above

or outside the environment, created in the image of their imaginary mystical god (hegemonic, monopolistic, imperialistic, superior) and, thus, supernatural in some ways or at least not part of the environment but separated from it. Perhaps attitudes like these have contributed to the economic successes and environmental failures of the industrialised north. In the African context, however, strong Evangelical and Islamic undercurrents with enormous funds and power have been proliferating on the fertile grounds of poverty, illiteracy, despair, innocence, credulity, trustfulness, anxieties and vulnerabilities. This strong faith-based knowledge is changing the environment-economy equation. At the praxis level, for instance, the islamisation of knowledge has transformed the Sahel, Magreb and Horn regions into massive pastoral grounds with deforestation and soil erosion aimed at raising sheep for, among others, the celebration of Aid el Kebir. The human crises in the heart of Christian Africa (Rwanda) and Islamic Africa (Darfur) can also be seen as environmental (economic-social) crises.

2.8 The transformative power of knowledge (knowledge impulsion)

Africans have developed powerful knowledge throughout history. The African spirit, ingenuity, creativity, cleverness, inventiveness and imagination gave birth to hominisation (bipedisation, juvenilisation, cerebralisation, manualisation) and humanisation (languagisation, fire domestication, *etc.*). *Homo sapiens* (scientists) and *homo faber* (technologists) are historically truly Africans. Also, the best *homo mythologicus*, *aestheticus*, *ludens*, *poeticus* and *consumans* are also African. In neolithic times, Africans had already developed rich empirical, logical, rational and analytical knowledge and developed powerful prescientific knowledge, which was really advanced in relation to previous knowledge. This prescientific knowledge was based on extensive botanical, zoological, ecological, pyrotechnical, geological, mechanical (tools making) and operational knowledge (hunting, fishing, housing, *etc.*). Africans have also made fine scientific and technological achievements in fields such as engineering (Pharaonic), writings, mathematics, physics, astronomy, medicine, transport, environment, knowledge of biodiversity, hunting, fishing, tools making, music instruments, plant and animal domestication. Today, African knowledge continues to excel in many areas, such as science (where African scientists earn international recognition), music and dances (where they perform in festivals all over the world), cinema, literature, theatre and paintings (where they win international prizes), food (where couscous, *injera*, *etc.*, are found in every major agglomeration of North America and Europe), sports and athletics (where many rank among the best in the world, as demonstrated again in the last Olympics) and creative hairstyles (where knowledge is being copied outside the continent).

3 Knowledge transition and adaptation

3.1 Transition to sustainable development that is not on course (knowledge deprivation)

More than half of Africa is not shifting towards sustainable development and not likely to be shaken out of its lethargy anytime soon in the absence of imaginative policies. A growing number of analysts and observers are talking of an unfolding African tragedy

and disaster and a worsening economic catastrophe. Poor development in Africa during the past 40 years has resulted in the worst aggregated economic disaster of the 20th century (World Economic Forum, 2003). More Africans are trapped in poverty today than when the continent first began shedding the yoke of colonialism in the late 1950s (The Economist, 2004). Africa may be destined to become "the festering disaster of our age" (Kissinger, 2001). The key MDGs are not likely to be met in decades, according to the United Nations Development Programme (UNDP).[10] These outlooks are perhaps too pessimistic for the slowly but steadily developing components of the region and perhaps too gloomy for its apparently knowledge-deprived nondeveloping components. But signs of some development in the region are encouraging. Governance is more democratic. Economic policies are better. Natural resources and commodities are in high demand and at better prices. Remittances have become more important than international aid and are on the rise. Relevant development knowledge is more accessible. Increased investments in many development areas, such as the internet and mobile infrastructures, agriculture colleges and infectious diseases, for instance, and some initiatives, such as the New Partnership for Africa's Development (NEPAD), will produce more positive impacts on economic growth and social progress in the years ahead. A lot of things are going in the right direction and all this points to brighter prospects for nearly half the region. Although the big picture is generally mixed, the half-stagnant, low-speed, knowledge-deprived components of AKSs are challenging and pessimism may be justified. Money cannot buy a culture of freedom and knowledge and it cannot buy the socioeconomic transformations necessary for the transition to sustainable development.

3.2 Obsessive knowledge for sustainable development (knowledge obsession)

The protracted, complex, largely improvised and uncertain transition to sustainable development in Africa cannot be achieved without an obsession with true and effective knowledge. This is necessary to dramatically increase the contribution of scientific, technological and technical knowledge to development. Indeed, scientific knowledge is increasingly required to understand, develop and manage terribly complex human-environment systems, such as infinitely intricate African systems, which are embedded in a highly unbalanced, unjust and unsustainable larger global system. Also, technical and technological knowledge – a technology can be conceptualised as "applied knowledge" or a "materialized knowledge system" – is required to address the acute environment, poverty, hunger,[11] health and unemployment nexus of crises that plague large parts of the continent. Knowledge is presently revolutionised by the development of a global artificial cerebrality fuelled by a growing planetary information and communication system[12] and economic liberalisation and globalisation. This knowledge revolution can accelerate and sustain the transition to development, which requires more effective, empirical, logical, technical, analytical, humanistic and rational knowledge and less impotent, occult, hermetical, orthodox, doctrinaire, mythological (Mbiti, 1990), anachronistic and prophetic knowledge. But before all, it requires obsessive and passionate (Pfeffer and Sutton, 2000) knowledge that can excite religious fervour and mobilise energies and effort towards sustainable development.

3.3 A 'passage obligé' to sustainable development (knowledge rejuvenation)

As we move forward into the new century, superior development knowledge bases, knowledge assets and knowledge capital (May, 1998), including but not limited to scientific and technical knowledge, are conceivably the ultimate development resources for realising the transition to sustainable development. They may also be the only real antidote against archaic mythologies, ideologies, superstitions and prejudices and against illiteracy, illness, degradation, unemployment and starvation. These rank amongst the foremost issues of sustainable development – a myth of non-African origin stemming more from the excesses and 'collateral' damages of modern development than from the tough problematic of a myriad of relatively small slow-developing traditional and globally marginalised societies. Superior development knowledge in the hands of African youth remains the answer and the way out to Africa's multiple crises. It is a *passage obligé* to sustainable development. This *passage obligé* requires that new knowledge pervade the relatively young African population that is more exposed and prone to social and cultural changes than their parents and grandparents. The average life expectancy of AKSs is about 47 years of age,[13] while the life expectancy in the industrial north is above 75 years[14] – a 28-year difference. The median age in AKSs is 18.3 versus 38.9 in Western Europe – a huge difference (more than double).[15] In addition, the life expectancy has been declining in many AKSs[16] in recent years.

3.4 A boost and a hope for sustainable development (knowledge progression)

Admittedly, many Africans do not seem to be on a development path for reasons that may not seem, at first sight, to be closely related to the lack of appropriate scientific and technical knowledge. Many parts of Africa, for instance, may not be developing properly and sustainably simply because they have never 'seen' development and do not know what it is, they are not attracted by or fear modernisation, modernity (Lyotard, 1991), which is inaccessible on a global scale, appears to be totally out of reach, there is a generally oppressive and highly conformist culture, Africans are jealously attached to century-old traditions or they religiously pursue the myth of salvation and immortality promoted by overwhelming and growing human and physical infrastructures, including social and media machineries.[17] In this context, *homo economicus* may by largely recessive. Nevertheless, the sound management and application of scientific and technical knowledge (OECD, 2000) possibly constitutes the greatest agent of change – a producer of food, health, wealth, jobs and human progress – and, at the opposite end, its non-application, may constitute the greatest producer of social and cultural rigidities, poverty, stagnation, regression[18] or unsustainable development. Scientific and technical knowledge can provide a hope for many African countries whose human indexes are stagnating at low levels.

3.5 African economies in need of transformation (knowledge modernisation)

A better and more intensive utilisation of scientific and technical knowledge (engineering, medical, industrial, agricultural, business, military, *etc.*) has to be part of any innovative solution to multiple global and regional development crises, calamities, misfortunes and tragedies. The transition to sustainable development requires AKSs and AKEs – comprising all knowledge relevant to sustainable development – to be more

progressive than they are now. Scientific and technical knowledge is a very powerful innovative force in history and a generator of immense inequality between nations and humans. At the global level, for instance, knowledge advance is a chronic and significant disturber of comparative advantages. Knowledge-rich exporters in advanced knowledge and innovative economies and also in a growing number of developing countries (such as Thai rice farmers and Chinese manufacturers) may threaten many less innovative African producers who are not producing enough manufactured goods and not producing and marketing enough food for a rapidly growing population. Most African countries have failed to redesign and modernise their traditional farming systems, methods and practices to meet local needs and face international competition. This has negative impacts on other sectors, such as education, health, labour, the environment and industry. Economic development is slowed down and sustainable development is not on course. In these conditions, scientific and technical knowledge may virtually provide a lifeline for agricultural transformation and sustainable development and is critical for moving the continent forward.

3.6 Radical changes needed for sustainable development (knowledge regeneration)

Sustainable development can only be fully realised at the regional level if it is being substantially realised at the global level and vice versa. In the current context of ever-growing global inequalities and irreversible environmental damages, Africa has to judiciously forge its own future according to its own interest. In a world where cars continue to shed billions of tonnes of pollutants into the air each year and where water, forests, lands and biodiversity continue to be degraded,[19] one may ask if the sustainable development paradigm is not yet another myth that will turn out to be another mirage. In any case, the sustainable development paradigm – which could eventually evolve into a 'knowledge for all' paradigm – is currently (and for the foreseeable future) the most powerful and practical development paradigm at hand, a paradigm capable of bringing about the radical changes needed to achieve a prosperous or decent and sustainable livelihood for everyone. Regardless of a lopsided process of globalisation of knowledge, Africans, in cooperation and partnership with the industrialised world, have to solve their own sustainable development crises, including the unsustainable exploitation of the resource base, notably the unsustainable use of agricultural soils that continue to be eroded, desertified, mined, depleted and impoverished.

3.7 Relevant knowledge for major renewal (knowledge renovation)

Benefiting more from local knowledge can only be achieved with modern scientific and technical knowledge. Scientific and technical knowledge can validate and upgrade indigenous or mythological knowledge and drives modernisation – a myth pursued relatively successfully by more than a quarter of the African population, particularly those from well-connected, entrepreneurial and opportunistic urban quarters. It is mostly European- or American-centric and its relevance for African development has to be assessed on a sector-by-sector or case-by-case basis. Only a tiny fraction of the potential is utilised, but its use is growing. It needs to be discovered, cultivated, harvested and promoted more vigorously for socioeconomic transformation. It emerges mainly from questioning traditional forms of thought, which could be encouraged throughout AKSs

for removing the obstacles to modern knowledge generation (Godin and Gingras, 2000), acquisition,[20] dissemination (Altbach and Teferra, 1998) and diffusion and transforming deficient knowledge edifices into efficient ones.

4 Knowledge globalisation and innovation

4.1 Knowledge flows and globalisation (knowledge circulation)

The globalisation of knowledge has been extremely important for African development throughout history. The Romans, Greeks, Persians, Turks and Arabs brought some of their knowledge into North Africa more than 2000 years ago and brought back African knowledge to their countries. The Arabs and Chinese brought oriental knowledge by trading on the West Coast of Africa for centuries. The Indonesians colonised Madagascar. In terms of development knowledge, the knowledge of wheat, barley, sheep and goats were introduced into Africa *circa* 6000 Before Christ Era (c.6000 BCE); horses were introduced into Africa from Palestine c.1700 BCE. Dromedaries were introduced into Egypt c.250 BCE and camels were introduced into the Sahara desert c.100 BCE. The African production of iron reached Meroë c.580 BCE, West Africa c.500 BCE and East and South Africa c.400 BCE (Philip's, 2002). Knowledge of rice, cotton, mango, bean, cress, lettuce, muskmelon, onion, pea, radish, rhubarb, spinach, cucumber, endive and orange originated from Asia. Knowledge of bush bean, kidney bean, corn, eggplant, potato, sweet potato, tomato, pumpkin, groundnuts and tobacco originated from Central and South America. Knowledge of sprouts, cabbage, leek and parsley originated from Europe. Technological knowledge (electricity, telephones, roads, airplanes, military), administrative knowledge and knowledge of international languages, *etc.*, came into Africa from Europe. Today, knowledge comes into the region through a variety of mechanisms, including the internet, radios and satellite TVs. The globalisation of knowledge is as important today for Africa's development as it has been since ancient times.

4.2 Knowledge migration and learning (knowledge acquisition)

Studying abroad is an avenue that brings modern – if not the latest – knowledge into Africa. It is estimated that 130 000 Africans are studying in industrialised countries.[21] Still, the number of agricultural researchers per million agricultural workers, for example, is around 42 in Africa and around 2400 in industrialised countries. An important knowledge issue here is promoting ways to acquire new embodied forms of knowledge relevant to Africa's development and the domestication or Africanisation of this knowledge. AKSs must be fully open to these channels of knowledge transfer and acquisition, which must be part of any comprehensive development strategy. South Africa (as well as South Korea) may offer best practices in this area. Industrialised countries have a responsibility to formulate and implement policies to maximise the contribution of this knowledge to the development of the African continent. This includes revising the stringent security measures put in place in the wake of September 11 that keep many Africans from pursuing their education abroad. Nongovernmental Organisations (NGOs) also bring some knowledge into Africa that is useful for sustainable development. Most are doing a good job, particularly those working in the

areas of humanitarian relief, education, health, energy, human rights and gender issues. Recently, critics of the work of some NGOs have become more serious, particularly towards those that have ventured into areas such as economic policies, globalisation, indigenous knowledge, genetically modified food, governance and religious proselytism. These are areas in which some NGOs may be spreading confusing, if not conflicting, knowledge. Spreading Middle Eastern knowledge in religious institutions, particularly in Islamic countries, is often done through forcing or instructing a child to repeat over and over machine-like religious incantations until it possibly spoil, blemishes or tarnishes his or her mind, psyche, mentality and intellect or injures his or her knowledge acquisitive and creative ability. Less than one African in a thousand escapes the religious cosmology, system of beliefs and world views he or she is born into. Access to modernity requires more autonomous thinking. Prophetic knowledge learned by rote may be the worst form of knowledge acquisition. To avoid obvious abuses, religious teaching methods could be regulated through an African Charter of Human Rights.

4.3 Licensed, leased, outsourced knowledge (knowledge utilisation)

Licensed knowledge (knowledge used against royalty payments) is very low, concentrated in a few sectors and countries (particularly the Republic of South Africa (RSA) – a knowledge hub). This very low level of utilisation reflects Africa's low capacity to use this kind of knowledge for its development. In addition, African countries are generally reluctant to pay royalties for knowledge. Knowledge, in some cases, is just a commodity that can be rented for production purposes. If renting knowledge is profitable, then there should not be any reticence of doing business with this knowledge. In the 1970s, African countries promoted the idea of an international code of conduct for technology transfer, limiting the percentage of royalties to be paid to use the knowledge associated with the technology. This approach did not succeed because these royalty payments must be negotiated on a case-by-case basis. Industrialising countries generally make extensive use of licensed and franchised knowledge. Not using this knowledge forecloses important knowledge sources for development. Complementary external or leased knowledge is acquired from an estimated 100 000 to 130 000 non-African expatriate knowledge workers – a relatively small number by any standards – reflecting Africa's low level of economic development and a difficult policy and security environment for expatriates. This leased knowledge should be better linked to knowledge transfer and appropriation mechanisms. Policies need to be dramatically improved in many parts of the continent to attract the needed foreign knowledge workers. These policies should go way beyond the issuance of working permits and include tax considerations, the right to buy land and properties, long-term visas, dual nationalities, *etc*. Foreign and African companies have complained that recruiting foreign expertise is difficult in many parts of the region.

4.4 Drained and foreign knowledge (knowledge patriation)

An estimated 20 000 professional knowledge workers (such as doctors, nurses, teachers, engineers and scientists) leave Africa every year and more than half of foreign-born students who get doctorates in the USA stay there. It is estimated that 30 000 Africans holding a PhD work outside Africa. These numbers are likely to remain high and even increase, as industrialised countries need to attract knowledge workers to compensate for

low birth rates and fill unwanted jobs. There is a wealth of knowledge among Africans in the diaspora that could be better exploited. New knowledge generated outside the region is also coming through partnerships (complementary knowledge), joint ventures and Foreign Direct Investments (FDIs). In many cases, there is no other alternative to these knowledge acquisition mechanisms. There exists an abundant literature and numerous meetings have been organised on these transfer channels. FDIs can and must be strengthened for the benefit of both the transferors and transferees. Many African governments have not opened a number of important sectors of their economy to FDIs, such as banking, insurance, communications, agriculture and others. The important issues here concern not only attracting efficient and competitive knowledge, but also promoting ways to internalise this knowledge. Africa can acquire a lot more knowledge from FDIs, partnerships and joint ventures through adequate policies than the present case.

4.5 Intelligence gathering for modern development (knowledge prospection)

'Spying' for knowledge – legal or illegal – has been practised since time immemorial and is still practised today by many governments and corporations. It is a cliché that in the 1960s, legions of Japanese armed with cameras scanned the world in search of industrial knowledge. The Russians used their network of embassies to do the same. Most industrial countries and industrial corporations practise some forms of industrial intelligence gathering through various means, some of which gives rise to frequent lawsuits or the expulsion of diplomats for activities that are incompatible with their status. African countries, on the other hand, do not practise 'espionage' to acquire knowledge useful for their development. Perhaps there is a need for African embassies to focus more on commercial activities and economic development through intelligence gathering than purely on state or diplomatic relations with little economic content or impact.

4.6 Innovative economies depreciating African economies (knowledge devaluation)

Rapid scientific advances and technological innovations of historical proportions empower the most advanced knowledge economies, leaving large parts of Africa behind (The RSA is a special – more advanced – case). Surely, in spite of important progress, many knowledge-poor or knowledge-deficient Africans remain currently relatively incapable, uninnovative and uncompetitive (Lall and Pietrobelli, 2002) in many areas critical to their development, even if African inventiveness produced key evolutions and innovations in history. Asymmetric global advances and innovations may eventually lead to a wholesale depreciation of traditional agricultural economies and an accentuation of the resource curse. The Africans stuck in somewhat rigid, stagnant, inert, stale, divisive knowledge bases are particularly vulnerable and susceptible to be bypassed by development.

4.7 Africa in the midst of a global knowledge race (knowledge competition)

In a rapidly changing geography of knowledge and a highly competitive world environment (Jackson *et al*., 2003), Africa can develop and compete in many product niches without going through the normal historical trajectory, but cannot do so without

the necessary modern information, the internet (FAO, 1998) and energy infrastructures (such as those required to read in dark evenings, for radios, TVs, mobile phones, computers, *etc.*). This requires huge efforts and investments that are often beyond the means of developing Africa. These efforts and investments are often partially supported by major international investors, bilateral donors and partners, multilateral lenders, NGOs and others. But local capacity building in development knowledge is necessary to meet ever-growing global competition. In fact, African societies and economies are being involuntarily drawn into a global knowledge race (Otsuki *et al.*, 2000), which they may lose because of the lack of effective knowledge strategies and policies.

4.8 Knowledge production (knowledge generation)

The knowledge race is real and poor performance has negative consequences. One of the main knowledge issues in development policies revolves around the fact that Africa is not generating by itself much new knowledge for development, although the African adventure is a source of inspiration for current generations with respect to innovation and new knowledge. Knowledge creation through research and development is an understaffed, underequipped and underfunded activity (less than 0.5% of GDP compared with more than 2% for the advanced economies) and too disconnected from the potential users to be really effective. It is concentrated in agriculture where it has some successes and failures, but it also leads to few industrial applications. In agriculture, research has not been sufficiently effective to support a green revolution on the continent. Nonetheless, some significant, scattered and possibly overlapping research activities are being carried out in more than 300 research centres in the region, which are useful for creating, learning, assessing, adapting, disseminating, demonstrating and monitoring scientific advances in critical development areas.

4.9 A knowledge 'tsunami' of opportunities driving world development (knowledge proliferation)

Undeniably, modern world development is currently driven by one of the largest knowledge 'tsunamis' to occur in the last few thousand years. Perhaps with the exception of antique Mesopotamia (agricultural knowledge, writing knowledge, *etc.*), ancient Greece (philosophical knowledge) and the Renaissance/Enlightenment era (scientific, technical, literary, artistic knowledge), this tsunami ranks amongst the most fertile, creative, productive, fruitful, exciting and inspiring periods in the history of knowledge. Supported by pervasive prodigious developments in ICTs (e-governance,[22] e-education, e-medicine, e-commerce, *etc.*), a robust global research system, a neoliberal free-market ideology and trillions of dollars of profit-seeking investments, it fuels a growing planetary knowledge system in which Africa, in its diverse parts, is entangled, buoyed and integrated or marginalised. The unfolding megawave of new knowledge, which has been labelled by the UNDP the 'knowledge millennium', can provide a new impetus for sustainable development. It can provide a range of openings that could be more fully identified and exploited – the key to knowledge-driven development. As a matter of priority, African policy makers could pay more attention to and make more effort to emphasise the centrality of knowledge for sustainable development and seriously face the challenge of making the most of the knowledge opportunities that are arising.

5 Knowledge edification and integration

5.1 Integrated knowledge edifices (knowledge integration)

Efficient knowledge edifices require that modern scientific and technical development knowledge be better integrated with itself and with indigenous, mythological, demagogical, metaphorical, poetic, ideological and faith-based knowledge. Meaningful development needs to be built on a variety of knowledge and on less compartmented and isolated knowledge bases. Modern knowledge creation increases exponentially and forces all disciplines to fragment into an increasing number of specialisations and narrow expertise, with knowledge monopolies and privileges. In this context, the ever-growing process of division of labour produces ever more specialised knowledge, understood only by specialists and experts. The result is ever more fractured and dismembered knowledge bases, which makes it hard to acquire a broad and integrated view in any given area or branch of knowledge.

5.2 Managing critical knowledge challenges (knowledge negotiation)

The fragmentation, disciplinarisation and professionalisation of knowledge can be partially overcome by integration processes which can be facilitated by the appointment of high-profile and highly credible and respected Science Advisors or Chief Knowledge Advisers (CKAs), as chief knowledge development strategists, whose mandate would be to assess knowledge strengths, weaknesses, failures, shortcomings and opportunities, develop knowledge indicators, evaluate the knowledge landscape and knowledge divide, identify knowledge gaps and requirements (World Economic Forum, 2002), formulate knowledge challenges, encourage knowledge criticism, support knowledge markets, multiply knowledge sources, develop hybrid knowledge bases, promote knowledge portals, hubs, factories (such as knowledge centres or centres of excellence) and media, promote the training of specialised knowledge workers,[23] develop new mechanisms for knowledge acquisition and trace possible knowledge futures. CKAs could also organise national dialogues and provide advice on international negotiation on some key issues related to science and technology for sustainable development (National Research Council, 2002).

5.3 Knowledge forums, networks and centres (knowledge defragmentation)

The setting up or strengthening of institutions and activities such as technology incubators, science parks, seminars, conferences, user groups, forums and networks can also promote knowledge integration processes. Political committees such as the Parliamentary Committees on Science, Technology and Innovation (PCSTI), already in existence in a growing number of African countries, and interdepartmental coordination forums such as Science, Technology and Innovation Forums (STIF) can be extremely useful for sharing and defragmenting knowledge. Design teams on the AGR can also enhance knowledge integration processes.

5.4 Knowledge infrastructures and institutions (knowledge mission)

Efficient knowledge edifices require greatly expanding and strengthening the various layers of modern scientific and technical knowledge. Curricula could be revised to include more science-oriented topics and scientific and technical disciplines and careers could be encouraged, particularly for women. Human resources development for innovation (Krogh *et al.*, 2000a), including socioeconomic and political innovation, could be accelerated. Scientific literacy could be raised significantly. Scientific associations, knowledge communities, learned societies, guilds[24] and academies could be adequately supported. Knowledge transfer (Argote, 1999) through a variety of mechanisms and channels could be considerably facilitated. Knowledge infrastructures (Stiglitz, 1999) and institutions could be strengthened or upgraded. Africa does not produce much patented knowledge or other forms of protected development knowledge and some of this patented knowledge is not exploited, which reflect the difficulties of application (in addition to the difficulties of creation), due to unenabling innovation and business environments. Patented knowledge creates rarity and, for this reason, value. Global and regional institutions in this area are working hard to assist inventors and creators and build capacities.

5.5 Unused, underused and underexploited knowledge (knowledge dispersion)

A better integration of idle knowledge in the knowledge edifice is also necessary. The number of knowledge workers who are unemployed, underemployed or misemployed, particularly among recent university and college graduates, is reported to be high in the region (25%–40%). Perhaps there is a need to establish more programmes that will help these knowledge workers get their first job on the labour market, in line with similar programmes in industrialised countries. Perhaps there is also a need to help university and college graduates create their own jobs. The idea is to minimise the loss of useful knowledge for development. Knowledge that is not used (and updated) is likely to deteriorate. Only massive job creation can solve the problem of idle knowledge workers.

5.6 Privatised knowledge (knowledge appropriation)

Privatised knowledge needs to be better integrated in the sustainable development effort. Newly created knowledge in some areas, such as in modern biotechnology and genetic engineering, is being privatised by multinationals, corporations, research organisations and private researchers, unlike during the 1960s and 1970s, where research in the area of agriculture, for instance, was in the hands of publicly funded governmental or international research centres and where all the generated knowledge was made available to developing countries. This evolution puts Africa at a disadvantage since it does not generate much of the new knowledge that it needs for its progress and it is reluctant to pay royalties for externally generated knowledge. It raises a number of issues related to the private property aspects of this knowledge and its impact on development. Privatised knowledge also has some positive aspects. It generates knowledge that would not be generated otherwise. It may also generate a level of dynamism that may not occur when knowledge does not belong to anybody and for which the profit motive is not an incentive. The problem is that there are few private organisations in Africa capable of

generating new knowledge. Perhaps the Group on International Agricultural Research (CGIAR) system, recentred on African needs, could acquire some of this private knowledge and redistribute it freely to knowledge seekers and users.

6 Knowledge constellation and clustering

6.1 Packages of green revolution knowledge (knowledge agglomeration)

An emphasis could be put on promising clusters of scientific and technical knowledge and exploiting these clusters for mission-oriented development (Maskell, 2001). Green revolution design teams, for instance, could be set up, among other things, to develop various packages of scientific, technical (agricultural) and organisational knowledge (Sanchez, 2001) that are at once required to achieve, as a matter of priority, the AGR throughout the continent. Indeed, there are many reasons why the AGR has become a matter of survival for millions of Africans. The average productivity of agricultural land in Africa, for instance, is lowest in the developing world, standing at only 42% of that in Asia and 50% of that in Latin America. The productivity of agricultural labour is also very low, amounting to less than 60% of that in Asia and Latin America. An AGR will increase agricultural productivity (Thirtle *et al*., 2003), ensure food security and lay out solid foundations for sustainable development. Indeed, an AGR, mainly through the massive application of more productive agricultural knowledge and technology, provides a central thrust around which the battle against underdevelopment, food insecurity, unemployment, poverty, land scarcity and bio-energy shortages can be waged. In this regard, the African Green Revolution Initiative (AGRI) promoted by the Economic Commission for Africa brings together knowledge designers (which knowledge is needed, who needs it, where and how to get it, how to transfer it, *etc.*), knowledge producers, knowledge multipliers and knowledge appliers. This approach builds on other approaches in which development experts and analysts have proposed interlinked efforts in agricultural knowledge's three main blocks – research, extension and education – variously called an agricultural knowledge system, an agricultural knowledge information system (FAO and World Bank, 2000), an agricultural knowledge triangle or a knowledge quadrangle, which include stakeholders and farmers (InterAcademy Council, 2003).

6.2 Knowledge designs, linkages and systems (knowledge cultivation)

The core of AGRI is to microdesign (or redesign) farming systems and sustainable AGR policies for various agro-ecological and socioeconomic environments. Certainly, the very concept of an AGR needs to be adapted to modern times, taking into account the lessons of:

- the Asian Green Revolution; the development of modern biotechnology
- the complex African farming systems
- the integration of crops and livestock production
- the increasing role of the private sector in the provision of the necessary inputs and agro-processing

- the development of markets for agricultural outputs
- sustainability concerns; the progressive globalisation of agriculture, including agricultural technologies, information, finance, investments, research, knowledge, expertise (including of expatriates), food aid and food trade.

The linkages between the farms, markets, gender, finance and industry also need to be better taken into account and priorities be given to high food deficit areas with agricultural potential.

6.3 Promising new knowledge (knowledge selection)

New advances in biosciences and biotechnologies can give a special boost to the AGR. Indeed, these hold great promises and should be pursued aggressively. The rapid development of biotechnological sciences – for instance, genetic marking, recombinant DNA, tissue culture and genomics – has opened up all sorts of possibilities to contribute to the AGR. The promise of biotechnology as an instrument for Africa's development lies in its power to improve the quantity and quality of crops and animals swiftly and efficiently. The time necessary to design and fashion advantageous qualities through traditional crops or animal breeding could be drastically abridged. Increased precision in plant and animal breeding could translate into improved predictability in the performance of the resulting products. The application of biotechnology could fashion plants that are more drought-resistant, more resistant to pests and more salt-tolerant without or with less polluting chemicals and unwanted side effects. Crop yields and animal products could be increased significantly. A greater variety of plants could be cultivated on a larger diversity of soils and marginal lands. Plant characteristics could be genetically altered for faster growth or earlier maturity, increased transportability and shelf life, reduced post-harvest losses and improved nutritional characteristics. Vaccines against diseases afflicting livestock could become important products of biotechnological research. Modern biotechnological knowledge could also open new opportunities in the agro-processing industry, environment and energy. All this new knowledge is strategic for Africa's development (particularly in a global free-trade environment) and could be promoted forcefully within an agreed regulatory security framework.

6.4 Exploitation of indigenous knowledge (knowledge validation)

Indigenous knowledge has proven its effectiveness. It is world-class expert knowledge, but is often little known or effective outside the tribe in which it is passed on. Sustainable development will have to be supported by this knowledge. It can contribute to the AGR and the larger sustainable development effort (Woytek, 1998). It can also hinder this effort. It sustains the subsistence of a good number of Africans and is geared more towards the past than the future. It is effective for reproducing and enhancing developing societies, but not sufficient for the profound structural transformations that are required for sustainable development. Some pre-modern knowledge may even constitute irrelevant leftovers from societies that disappeared centuries ago and may hold back development. More attention could be paid to antique, tacit (Leonard and Sensiper, 1998), oral, occult, esoteric, arcane, secret, camouflaged (sorcerer's knowledge), endangered, pirated,

remunerable and devalued indigenous knowledge. There is a need to identify, record, describe, test, analyse, validate, codify, protect and exploit this knowledge to the fullest extent possible.

7 Knowledge demythologisation and remythologisation

7.1 Scientific knowledge and scientific culture (knowledge de-deification)

Mythologies hypnotise people, particularly early in childhood. They manipulate societies as much as societies manipulate them. In Africa, mythological gods – not scientific knowledge – pervade African mindsets. These gods have the power to invade all areas of human life ("To a man with an empty stomach, food is God" – Mahatma Gandhi). This is exemplified by the following examples taken from the local press. A group of Imams in northern Nigeria obstinately defends the idea that God commands all African men to grow beards in a certain shape and length. A young Mauritanian girl agrees with genital mutilation, veiling and forced marriage 'because god wants me to'. A preacher in Sudan explains the particular way god wants wives to be beaten by their husbands. Still more telling is perhaps what is not making news. Indeed, the African Christian mindscape, for example, is full of truly amazing weird-winged anthropomorphic figures or humanoids such as phantoms, ghosts, angels, archangels, guardian angels and devils. It is full of myths such as divine conceptions, guiding stars, annunciations, miracles and salvation – mythologies that predate Christianity. These mythologies thrive on extensive cults, rituals and celebrations. Mythological indigenous knowledge, on the other hand, is filled with deities, spirits, specters, chimeras, fantasies, superstitions and taboos. They give rise to a world obscured by pre-modern fallacies, fictions, phantasmagorias, misconceptions and confabulations. In many African languages, the word 'god', particularly in Islamic and Christian Africa, is continuously repeated throughout the day in salutations, enquiries, thanking, *etc.* Mythologies and superstitions are by no means limited to Africa and developing countries, but African mythologies, whether imported or home-grown, do not help to bring about a scientific culture and can be – under certain conditions – counterproductive to achieve sustainable development. This is the case, for instance, for competing with China (Africa's main industrial competitor) in low-tech industrial goods. There is an urgent need to de-deify African knowledge.

7.2 Faith-based knowledge lacks critical values (knowledge valuation)

Faith-based medieval (Middle Eastern) orthodox knowledge could also contribute more to the sustainable development effort. This knowledge provides sound ethical bases for development, but these are largely incomplete and insufficient for sustainable development. It profoundly dominates and domesticates the collective psyches, behaviours and development of a vast majority of Africans. Indeed, Evangelical[25] and *Qur'anic*[26] knowledge, for instance, is amongst the most powerful 'soft' knowledge ever fashioned by humans and possibly the most influential knowledge possessed by many Africans who, in turn, are somewhat possessed by this knowledge. This double possession may excessively focus many African minds on speculative knowledge for life after death (Wiredu and Gyekye, 1992) and on somewhat irrelevant and unproductive

knowledge for sustainable development. To contribute more to sustainable development, this knowledge could evolve into more efficient value-laden knowledge, such as democratic governance, fundamental freedoms, gender equality and the full utilisation of feminine talents, ingenuity and knowledge, affection and care for nature, a concern for future generations, superiority of scientific knowledge over saintly scriptures and a focus on life before death[27] – all necessary conditions of knowledge-enhanced sustainable development. Indeed, an emphasis on life before death and relevant and reliable knowledge for sustainable development could save millions of lives. Vigorously promoted by a pervasive and expanding physical and human infrastructure[28] – not exactly a fountain of fresh knowledge – this knowledge, under certain conditions, constitutes a virtual owner's manual for one's life, especially for Africans-of-one-book (Hamel, 2004), which under certain conditions may not be conducive to sustainable development.

7.3 Ineffective mythological knowledge could evolve (knowledge evolution)

History has abundantly demonstrated that humans need and will always need convenient myths to cope with a harsh reality (for sleepwalking), which is particularly intense in many parts of the region (a neurotic compromise?). Humans also need myths to advance scientific knowledge and progress. In fact, scientific knowledge would not have advanced as much if scientists, such as many who saw themselves as messiahs and prophets or identified themselves with the 'divine watchmakers', did not work all their lives trying to reveal the hidden mechanics of the physical and biological world. Mythological knowledge can be a very powerful force of innovation and cannot or should not be reduced, but must evolve or be displaced, replaced or superimposed with more future-oriented, valuable and efficient mythological knowledge. Knowledge created centuries ago for the governance of small quarrelsome and illiterate desert tribes may not be the most appropriate for governing the complex, globalised and knowledgeable societies of today. There is a need to demythologise/remythologise the African knowledge landscape. This is the most daunting African challenge.

7.4 Faith-based knowledge could be desacralised (knowledge defetishisation)

Desacralising and detabooing economically inefficient, fetishistic and untouchable knowledge can go some way in putting some of the fundamentals right for development. No African, for instance, should conform his/her acquisition of knowledge to the dictate of another person or another institution, be indoctrinated with doubtful knowledge, be irresponsible for his/her own knowledge choices or consider his/her knowledge system always better in every respect than others. No African should be forbidden access to some knowledge vehicles (such as music, literature, political essays, arts). No African should transpose his/her religious beliefs with politics or be persecuted for choosing his/her own independent knowledge. No African should be jailed for blasphemy or heresy, exploited in the name of revealed knowledge, discriminated against on the basis of faith-based knowledge, castigated for abandoning vaporous prophetic knowledge or punished for changing faith-based knowledge systems (apostasy).

7.5 Prophetic knowledge cannot justify discrimination or interference (knowledge erosion)

No indigenous or Abrahamic knowledge system should provide unquestionable justification for the number of wives (or husbands) and concubines someone may have. No prophetic knowledge should erode the independence of the judiciary and the rule of law and no university should be manned with teachers who are not fully open to knowledge and cannot produce scientists and professionals open to knowledge. Africans adhering to distinct faith-based knowledge systems should have equal status in education, business, justice and politics. Data on religious belonging should not be collected and put on identity cards, passports and administrative documents and adherence to a particular knowledge system should not be a condition for getting a job, marriage or acquiring nationality. Changing regulations, traditions and practices in these respects could create better conditions for sustainable development.

8 Knowledge emancipation and liberation

8.1 Freedom could be the infinite fountain of knowledge (knowledge generation)

Uninnovative economies are typically the result of knowledge stagnation and fossilisation, which may be largely the product of a lack of freedom in all areas of life. In this situation, liberating knowledge could be made the priority of priorities. Indeed, freedom could be the ultimate and the infinite fountain of knowledge. As a result of this principle, sustainable development could be reflected or revealed, among others, by the proportion of Africans born free according to the spirit and letter of the 1948 Universal Declaration of Human Rights regarding the right to be born free and equal in dignity and rights (Article 1). It can also be assessed against the key right of freedom of opinion and expression, including the freedom to hold opinions without interference and to seek, receive and impart information and ideas through any media and regardless of frontiers (Article 19). Open, free criticism of cultures, traditions, laws and regulations is essential for sustainable development. There are too many African critics in jail or threatened and too many African thinkers who were driven out of their countries.

8.2 Knowledge liberation could top the development agenda (knowledge franchising)

In line with established human rights, sustainable development could require that Africans be born free: free of being born as an ‘Ancestor’, a Christian or a Muslim, free from a blind lottery, free from the myth of spirits and ghosts and the myth of salvation and immortality, free from cultural prejudices, social intimidation, persecution and conformity, free from knowledge manipulation, repression, contamination, illusion, monopolisation and pervertisation, free from sectarian education, getthoising (free for Muslim women to travel alone) and veiling (caging), free from undue social interdictions and prohibitions (such as for a woman to shake hands with nonfamily men, *etc.*), free from illiteracy, obscurantism and inappropriate knowledge relics of long-gone societies, free from the Bastille of self-deceptive knowledge and knowledge pathologies, anemia

and asphyxia, free from hallucinatory, schizophrenic, hysterical, infirm, anemic, impotent and debilitating knowledge, free from excessively ego-socio-ethno-chronocentric knowledge and pedant elitist knowledge, free from controlled, enslaving, fossilised, fractured knowledge and hermetic and incapacitating knowledge, free from untouchable, sacred, spam and junk knowledge and free to choose and use critical, revolutionary (Allee, 1999), dissident, subversive knowledge.

8.3 Knowledge advancement requires social and cultural change (knowledge oppression)

True sustainable development requires that Africans be liberated from obstacles to expressing, questioning, challenging, verifying and critiquing; liberated from established thinking, from the scare theatrics of sorcerers and witches and from 'elephant dung potions'; liberated from 'scattered bones' reading, from clerics and pastors' charms and from the ultraconservative and authoritative knowledge of the elderly; liberated from barbaric laws, treatments, punishments and mutilations (including sexual) inspired or justified by pre-modern knowledge systems; liberated from arranged marriages, from outdated food codes and canons, from autocratic and oppressive governance, from despotic kings and privatised states; and liberated from forced labour, patriarchal establishments and commanding husbands.

9 Conclusion: knowledge progression and evolution

9.1 Scientific mentalities for knowledge reforms (knowledge revitalisation)

What is needed is not so much the growth of the stock of scientific and technical knowledge and encyclopedic and scholarly knowledge, but the development of scientific thinking, scientific world views and scientific mentalities. The new ways of knowing and understanding and new mindsets are more important than new knowledge. In these perspectives, African knowledge could evolve in many directions to contribute more to sustainable development. It could evolve towards knowledge that is more autonomous (free-thinking knowledge), strategic (knowledge aiming at modernisation and progress), radical (fundamental, critical, outside-the-box knowledge) and rational (coherent with the North Atlantic technoscientific paradigm). It could evolve towards knowledge that is more competitive (to benefit from regionalisation and globalisation), universal (knowledge that is valid across tribes, ethnic groups and cultures), tolerant (open to deviant, heretic knowledge), transdisciplinary (comprehensible across professions) and sustainable (resistant to time and generations). It could evolve towards knowledge that is more imaginative, inventive, creative and innovative. It could evolve towards knowledge that is more utilitarian, instrumental, functional and operational. The alternative is to keep trying for African development with the somewhat nonperforming knowledge portfolios of sterile ancient or medieval knowledge – a sure way to lose the knowledge race and eventually kill millions of Africans in the process.

9.2 Long struggle for conceptual self-exorcism (knowledge decolonisation/depossession)

There is a need to make efforts to consciously initiate a long struggle of conceptual self-exorcism. All 'soft' knowledge could be thoroughly questioned and challenged. Scientific, rational, logical, empirical knowledge could corroborate and empower mythological and indigenous knowledge to better serve sustainable development. It could prevail over faith-based, divine, revealed knowledge. It could prevail over symbolical, superstitious, traditional knowledge. It could prevail over Abrahamic knowledge (which comprises evangelical and *Qur'anic* knowledge). Doubting and criticising is the key to wise, flowering and powerful revolutionary knowledge. Perhaps only deviant, disobedient and dissident African thinkers can deracinate some pre-modern knowledge that keeps half of African countries needing food aid and assistance.

9.3 Investments required in the social soil on which knowledge grows (knowledge cultivation)

Knowledge-driven sustainable development could be pursued more forcefully to narrow the growing knowledge gaps in critical areas, which will not be achieved in large parts of the region without profound reforms, Herculean efforts and massive investments. These could be pursued in the 21st century as aggressively as Africans pursued the myth of the independent nation-state in the 20th century. Indeed, effective knowledge pursuits could ensure and accelerate the ultracomplex transition to sustainable development. This raises daunting knowledge challenges. Bold policy initiatives in knowledge are needed to improve the social soil and environment on which it grows, keep abreast of knowledge advances, set in motion dynamic knowledge-improving processes, reduce knowledge deficits, free knowledge bases from impurities, strengthen knowledge infrastructures and institutions, fight knowledge obsolescence and increase overall knowledge performance.

9.4 Knowledge lovers could spearhead knowledge culture (knowledge acculturation)

Africans need to be empowered to realise a true knowledge revolution and take the high road to the knowledge age. They need to be empowered to embark on a new journey of sustainable development. Liberating the continent from deficient knowledge bases for sustainable development could mean supporting and promoting noncompromising lovers of knowledge and gardening quality development knowledge. It could mean strengthening the engine of knowledge, which is the infinite desire to learn and possess knowledge. It could mean developing specific knowledge competences (Lall, 1992) and knowledge rights and removing a host of obstacles to knowledge acquisition, production, revision and circulation. It could mean finding a more profound and meaningful communion with the essence of reality and playing the politics of knowledge more forcefully. It could mean opening and exploiting new critical knowledge avenues and encouraging and sponsoring knowledge-based employment-creating enterprises (Rogerson, 2001). It could mean cultivating a knowledge culture and inventing a new knowledge future.

9.5 Knowledge elites and leaders could play a special role (knowledge promotion)

African free thinkers, knowledge elites, knowledge leaders and knowledge organisationscould intensify their work toward evolving transcultural, transsocial, transethnic,[29] transreligious and transhistorical knowledge (jettisoning excess baggage). They could focus their work more on demythologising/remythologising the African continent with more relevant and less detrimental 'gaseous' knowledge and transform knowledge portfolios into more effective ones for sustainable development. Scientific and technical knowledge must play an important role in this endeavour. Superstitious religious or ancestral beliefs, preferences and practices need to be respected but, in case of conflict with well-established human rights, 'scientific realities' or technical superiority, the latter could prevail. Liberating the region from the shackles of medieval and ancestral knowledge is a major development challenge that cannot be faced without a decisive contribution from powerful scientific thinking and technical knowledge.

9.6 A new knowledge adventure for sustainable development (knowledge oxygenation/thermodynamisation)

Meeting the challenge of sustainability requires designing policy orientations that consecrate knowledge as the most significant resource for development. It requires launching and capitalising on a number of processes to reform, improve, cross-breed and strengthen knowledge, such as: uncovering, identifying, stocktaking, recording, describing, detribalising, analysing, testing, validating, codifying, protecting (Burch, 1995), patenting (Mgbeoji, 2001), hybridising and exploiting endemic, indigenous, traditional or local knowledge. It requires rethinking, questioning, criticising, demystifying, de-deifying, defetishising, desacralising, despiritualising, deprophetiing faith-based orthodox medieval knowledge. It requires auditing, de-institutionalising, decontaminating, secularising, 'decolonising' (Wiredu, non-dated) and modernising this knowledge. It requires producing (creating/generating), sharing, harvesting, cultivating, diffusing, democratising, 'Africanising' (Kwasi, 1992), 'indigenising', 'scienticising' and internalising various modern forms of knowledge. It requires reengineering, enhancing, valuing, thermodynamising (hot bubbling knowledge culture), feminising, rejuvenating, leveraging (Carayannis *et al*., 2000), emancipating, liberating, integrating, popularising and investing in all types of knowledge relevant and effective for sustainable development. Some of these processes could provide inspiration for designing knowledge policy initiatives adapted to specific knowledge environments and challenges in support of a more innovative, prosperous, hunger-free and environmentally responsible future. These initiatives, driven by the power of scientific thinking and technical know-how, could provide a needed boost to sustainable development in Africa.

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Notes

1 Knowledge as an alternative construct to culture is another means of observing that which is elsewhere labelled 'culture'.

2 Knowledge as an object or a concept has been discussed since Plato's *Theaetetus*.

3 "Knowledge is a more powerful weapon in a nation's arsenal than any missile or mine."

4 Such as sylligraphic systems (Ethiopic Writing System – Geez, Afan-Oromo Script, Amharic Syllographs, Ethiopic System with Numeric Values, Mende Script, Nsibidi, Vai Syllabry, Shumom Writing System), alphabegic systems (Bassa script), pictographic systems (Egyptian Writing System, Meroitic Script) and chromatographic systems (based on colour) from Ghana and Niger (Source: Africana Library, Cornell University).

5 Examples of symbols that resonate across AKSs include the elephant (symbol of power and kingship), the lion (symbol of ferocity, danger and royalty) and woman (symbol of peace, productivity, creativity, life and growth).

6 Magic is derived through acting with objects and words to conquer fear, predict the future, cast curses, fill wishes, heal, *etc*.

7 Rock art in AKSs are found in Algeria, Southern Morocco, Libya, Niger, Chad, Mauritania and South Africa (Africana Library, Cornell University).

8 A figure has the power to act on somebody. For instance, it can retaliate against wrongdoers and sorcerers or bring health, calm, security or fertility.

9 An example of an African proverb related to knowledge: "He who knows all, knows nothing."

10 According to UNDP, as of mid-June 2004, if the present trends continue, Africa will meet the goal of reducing poverty by half (an MDG goal) by 2147!

11 One African out of three (in Sub-Saharan Africa) is food insecure and half of the African countries need food aid.

12 The development of ICTs in Africa represents perhaps the greatest development successes in recent years in support of knowledge access and dissemination.

13 The figure for Sub-Saharan Africa in 2000 (Official UN Statistics on Population).

14 The average for Europe, North America, Australia, New Zealand and Japan in 2000, according to official UN statistics.

15 Official UN Statistics on Population.

16 The life expectancy in Zimbabwe plummeted from 56 years in 1970–1975 to just 33.1 years today. Zambia went from 49.7 years to 32.4 years in the same period, Lesotho from 49.5 years to 35.1 years and Botswana from 56.1 years to 39.7 years.

17 Egypt's Ministry of Religious Affairs, for instance, plans to connect some 5000 mosques with 10 000 loudspeakers, all blaring at once five times a day, to call people to prayers. In some African countries, religious organisations own or rent entire TV channels for televangelists.

18 In the 1990s, 14 African countries saw a deterioration of their human development indexes: Botswana, Burundi, Cameroon, Central African Republic, Congo, Democratic Republic of Congo, Côte d'Ivoire, Kenya, Lesotho, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe.

19 More pollution, contamination, degradation, depletion, extermination, destruction and division can be expected on a global scale, according the current trends analysed by the WorldWatch Institute.

20 The World Bank identified three key means to facilitate the acquisition of knowledge from abroad: an open trading regime, foreign investment and technology licensing.

21 In OECD countries.

22 According to ECA, by June 2002, there were about 706 websites representing African public institutions. Morocco, Egypt, Nigeria, Kenya, Mozambique, Mauritius and South Africa have the highest number of websites. South Africa leads the group with 138.

23 The concept of 'knowledge worker' was first formulated by management guru Peter Drucker in the 1960s.

24 A descriptive term for an organised group of suppliers of a specific kind of knowledge. Knowledge guilds guarantee a level of quality in business interactions with their members.

25 In the last two decades, there has been a recrudescence of proselytism originating from the Americas and the Arabic peninsula. Thousands of new churches and mosques have opened (often in rented houses). The new Evangelical churches are composed of numerous relatively new sects taking market shares from the main religious orthodoxies.

26 'Islam' in Africa is a multifaceted term covering various Muslim interpretations of the faith. The main interpretation is Sunni. In Sub-Saharan Africa, Islam occupies a dominant socio-culturo-political position in Northern Nigeria, Northern Cameroon and Northern Chad. In West and East Africa, the Sufi Brotherhood dominates, especially in Senegal, Gambia, Niger, Mali, Guinea, Kenya and Tanzania.

27 This observation is based, among others, on the author's personal visit to more than 700 African households during the last 31 years.

28 In many African countries, the construction of churches and mosques – due to the saturation or decline in other parts of the world and massive funding from Southern USA and Saudi Arabia – has become a major industry.

29 Ethnic-based politics in a continent where there are more than 700 ethnic groups can lead to chaotic situations, important instability and violent frictions. Governance has to be as much inclusive and pluralist as possible.