

ECONOMIC COMMISSION FOR AFRICA

**Advancing Knowledge for Meeting
MDGs and for Sustainable
Development in Africa:**

Fundamental Issues for Governance ⁽¹⁾

DRAFT RESEARCH PAPER

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¹ The opinions expressed in this paper do not necessarily represent the views of ECA, but those of the author.

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Abstract: *Knowledge may be the most powerful weapon against unsustainable development in Africa, which is characterized by interrelated high levels of poverty, hunger, illiteracy, illness, insecurity, superstitions, joblessness, cultural rigidities, eco-degradation and international dependence. It is becoming the chief currency of the modern age and a decisive resource for sustainable development. This paper reflects on the concept 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 characterizes 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 emphasized as the main driver of sustainable development and the potential contribution of indigenous and mythological knowledge is also stressed. In conclusion, the paper calls for the initiation of a long struggle of self-exorcism and for a profound reform of knowledge based on the premise that freedom is the infinite fountain of knowledge.*

Keywords: Africa; MDGs, science; technology; sustainable development; knowledge economy; knowledge society; knowledge management; indigenous knowledge.

1 Introduction

'Knowledge is a more powerful weapon in a nation's arsenal than any missile or mine' Kofi Annan, *Transcript of UN Secretary-General's Speech at United Nations University*, Tokyo, 5 May 2005.

"Being naked approaches being revolutionary" John Updike (American writer)

Dressed with their inherited cultures, mythologies and religions, development analysts and policymakers may be somewhat blinded to the revolutionary structural transformations that are needed over the next ten years to meet key Millennium Development Goals (MDGs) and achieve a successful transition to sustainable development on the African continent. Since conventional approaches to development have left much of the continent as deprived as it has ever been, and since the prospects of better days are mixed and bleak for half of the population, a new weapon may be needed to initiate and accelerate these required revolutionary changes. Powerful new knowledge may be this ultimate strategic weapon.

This paper explores such a concept of knowledge. Knowledge as a weapon for sustainable development evokes the idea of target, advantage, defense, struggle, rivalry, intelligence gathering, technology, conquest, annihilation, obliteration and demolition. In the context of this paper the target may include the inefficient knowledge bases that keep nearly half of Africans incapable of meeting their basic needs, incapable of meeting key MDGs and in need of international assistance. Used defensively it may be applied to the protection of African countries against the debilitating forces of globalization on endemic, traditional or

local knowledge. Used offensively it may target the upgrading of indigenous knowledge for producing goods and services that Africans demand. It may also target some non-enabling mythological faith-based knowledge that results from the colonization of large parts of Africa, which started centuries before the European colonization. It may target the construction of productive and competitive capacities to face up a number of daunting contemporary challenges. These are clearly embodied in MDGs and in the sustainable development concept. A weapon also evokes the idea of empowerment and of social control over its generation, its development, its maintenance, its distribution, its concentration, its monopolization, its protection and its utilization. These are some of the issues that are investigated in this paper.

The paper critically reflects on the notion of knowledge, African knowledge, African knowledge economies (AKEs), African knowledge societies (AKSs) and African knowledge policies for sustainable development. Its purpose is to contribute to sustainable development thinking in the African region and open a new front in the development discourse. War against unsustainable development can be won with more potent knowledge.

During the last decade many excellent initiatives have emerged in knowledge creation, dissemination, partnerships, networking, sharing and access, mainly through 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, although powerful affordable radios have been overlooked as powerful ICTs ‘for the rest of us’. This is perhaps the greatest weakness of ICTs as practiced to fight poverty. Other complementary initiatives may be necessary for the majority of Africans that do not use ICTs for learning, researching, communicating, accessing, sharing or partnering. It is these Africans, particularly those in distress, who are struggling with unproductive knowledge, who are failing to meet their basic needs and who are in dire need of sustainable development. This paper is an attempt to provide insight into the root causes of their failure to meet their basic needs and why key MDGs will not be met with current thinking and current approaches alone. A better understanding of these causes is a prerequisite for sound policy formulation and for designing complementary policy initiatives.

The paper is divided into nine sections. Section 2 discusses the hyper-complex concepts of knowledge as they relate to sustainable development. It provides new ways for the appreciation and evaluation of knowledge and its sustainability as a resource is theorized. It discusses the essence, the core, the mainstays and the ideology of sustainable development in Africa. The relation of mythological knowledge with the environment (eco-socio) is explored and its impacts assessed. Some ideas are put forward on the power of knowledge creation, on a knowledge paradigm (knowledge ecologization), on a meta-paradigm of sustainable development (sustainabilism), on complementary approaches to knowledge modeling and on the nature of knowledge representation in AKSs.

Section 3 deals with issues related to knowledge evolution and adaptation and to the long-drawn-out, makeshift and wavering transition to meeting MDGs. It emphasizes the crucial role of scientific, technological and technical knowledge, which can provide a hope and a boost for sustainable development and which must become an obsession for the acceleration of this transition. Science, technology and innovation is a ‘*passage obligé*’ to sustainable development and radical changes are needed to transform traditional African societies into more aggressive and modern economies on the global scene.

Section 4 discusses issues related to knowledge innovation, circulation, migration, acquisition, repatriation, utilization, prospection, devaluation and proliferation. It formulates some ideas on strengths and weaknesses of AKEs, emerging opportunities, drained knowledge, intelligence knowledge, knowledge flows, the need to compete internationally, the global knowledge race and the emerging knowledge mega-wave. It reflects on the lopsided globalization of knowledge, knowledge competition and the globalization of sustainable development in an unequal and unjust world.

Section 5 discusses issues related to the integration of compartmented layers of knowledge, the fragmentation of knowledge bases, knowledge ghettos and their integration through knowledge institutions, associations, academies, forums, portals, media, networks and centers. It raises the important issue of knowledge under-production and generation through research activities and knowledge dispersion and erosion through unused, under-used and under-exploited knowledge caused by high unemployment of knowledge workers, especially young graduates. The issues raised by the privatization of knowledge are also discussed.

Section 6 deals with issues related to knowledge constellation, clustering, designs, 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 new promising modern scientific and technical knowledge and to upgrade traditional knowledge with more powerful scientific and technical knowledge.

Mythological knowledge, particularly evangelical and *qur'anic* knowledge, which plays a dominant role in hypnotizing, mesmerizing and domesticating African societies, are discussed in section 7. The values underpinning this knowledge are analyzed in relation to their contribution (or non-contribution) to sustainable development. It argues for the need to demythologize / remythologize common, ordinary and trivial knowledge. This calls for a de-deification, demystification, de-prophetization, de-fetishization and desacraslization 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. Neglected development issues are explored and various policy directions regarding all types of 'soft' or 'gaseous' knowledge are suggested. The need to evolve revolutionary knowledge, free of ineffective mythologies, is stressed.

Section 9 concludes on the need to thermodynamize knowledge (hot, bubbling knowledge culture) and on the special role and responsibility of knowledge elites, leaders and lovers in bringing about a culture of freedom, enabling environments and scientific mentalities for a complete decolonization of knowledge and for innovative changes. It outlines possible policy orientations, knowledge futures and horizons for a new knowledge adventure that can help bring about the drastic transformations that are necessary to achieve a real transition to sustainable development on the African continent.

2 Knowledge Appreciation and Evaluation

2.1 Concepts of knowledge for sustainable development (knowledge conceptualization)

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, cultural¹, biological, political (Cohen, 1992), philosophical² 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, 2000a), a system (international and local), a wellspring (Leonard, 1995), a servant or a master. It can be seen as a mediator, a translator, an organizer, a constructor of reality. It can be seen as capacities, power and an enlarger of the domain of human destinies.

Knowledge has the potential of realizing the full plasticity of human societies and a range of possible futures. But because of its often fragmented, fractured, dismembered, atomized, localized, specialized, mutilated, dispersed, value-free (scientific) and de-contextualized character, it can be untapped, unused, misused, misapplied, misinterpreted or misappropriated. Modern knowledge can be an equalizer of cultures open to knowledge and a homogenizing force in history. It can be a springboard to development (USAID, 2004) and it can also be destructive of cultural diversities and of the environment. It is somewhat autonomous, selective (Plotkin, 1994), emerging, blind, fluid, transitory (Nonaka, 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 ultra-complex knowledge interactions).

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

All knowledge is ecological (comprising socio-environmental) 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, the glue, the meaning, the purpose and the organization of knowledge and society. Effective ideo-mythological and techno-scientific knowledge is the dual-engine that propels sustainable development. This engine is fuelled by enabling mythological knowledge environments (the mytho-environment), on the one hand, and by 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, poverty reduction, food security and improved prospects for the young generation. This calls for enabling knowledge environments for the acceleration of economic growth (Cohen, 1998), the rehabilitation of the resource base and the realization of an AGR. These are the critical mainstays of sustainable livelihoods, incorporating vital elements of the Johannesburg Plan

of Implementation (JPOI) and key MDGs targets – in themselves a workable vision, albeit mutilated, of sustainable development in the African context.

2.3 A knowledge-based meta-paradigm for sustainable development (knowledge paradigmization)

At the supra-level, value-laden mythological knowledge facilitates or hinders sustainable development in many ways and could give rise to a meta-paradigm of ‘sustainabilism’, incorporating vital knowledge for a new world knowledge order. This meta-paradigm could emerge in interaction with, in complementarity and in conjunction / opposition with other powerful paradigms influencing sustainable development. These include hygienism (HIV), regionalism (integration), hedonism, messianism, christianism, islamism, animism, mysticism, shamanism, charlatanism, fundamentalism, modernism, environmentalism, naturalism, democracism, tribalism, ethnocism, socialism, capitalism, liberalism, scientism, technologism (bio, ICTs), pacifism, consumerism (eco-consumption, GMOs), universalism (UN), feminism, humanism (genocide), nationalism, patriotism, 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 mythological world society, with world identity, world citizenship and knowledge rights (a distant reality). Such a society would require a re-conceptualization of knowledge for sustainable development, including its concentration (centric, un-centric, poly-centric), its hierarchization (hierarchic, un-hierarchic, poly-hierarchic) and its distribution (competence, poly-competence, specialization). There is a need to evolve a meta-paradigm of sustainabilism, coherent with a mythological sustainable world society, and investigate how various types and structures of knowledge can better contribute to its realization. This calls for a reproblematicization of sustainable development on a global scale.

2.4 Knowledge as a sustainable resource (knowledge sustainability)

A perspective on 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 for grasping and changing this reality. It is required for natural environments to be conserved, protected and rehabilitated. It is required for constructed environments, such as electronic, institutional, social, economic, cultural and political environments, for facilitating the circulation and use of this knowledge. Political environments, for instance, require full universal access to relevant knowledge for making sound political choices and for meaningful, participative and democratic governance. Cultural environments require the full utilization of all talents and available knowledge and a diversity of knowledge (UNDP, 2003). Economic environments require full access to knowledge to make rational economic choices. These environments must be organized according to the principles of sustainability, which can become the central organizing principles of AKSSs.

This means organizing 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 equality of opportunity in 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 accessible: humanitarian or assistance, royalty free and tax-funded. 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 monopolized, controlled, altered, sullied, devalued, 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 a fundamental 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, scientism 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 hundred years. Physics provides insight into knowledge as negentropy. Biologism reveals the ecological nature of knowledge (knowledge is an eco-library), processed from information gathered through perceptors, sensors and extractors. It provides insight into knowledge as a capital of eco-information that is computed and which involves proteino-electro-chemical-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 irrational pulsations, sentiments and behaviors 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 (*apriori* 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; 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 to the investigation of knowledge in relation to sustainable development can be useful. They can help to 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, as defined here, not limited to advanced societies and that goes beyond the prolongation of the information or the digital society (Barka, 2004). This is necessary for designing new policy initiatives (Conceicao, 1997). It is necessary for formulating relevant policy issues and directions, for upgrading anachronistic knowledge bases and accelerating the transition from largely pre-modern, knowledge-deficient, unsustainable AKSs to fast progressing or modernizing ones. In Africa, there is many indigenous writing systems³ but a large proportion of knowledge is not written, documented, formalized, standardized or certified – let alone patented or protected - but is expressed and communicated through other means.

In fact, African knowledge is profoundly dependent on signs, symbols⁴, myths and magic⁵. These permeate beliefs, arts, rock paintings⁶, clothes, songs, ceremonial objects, decorative drawings, tattoos, rites, masks, figures⁷, architecture, legends, fables, metaphors and proverbs⁸ (Dzobo, 2004). This knowledge is extraordinarily rich but is not very effective for modern development, which requires more precise, definite, utilitarian, tradable and codified ‘hard’ scientific and technical knowledge (Arrow, 1971). It is not very effective to produce watches and radios – the most coveted technologies by the poor in AKSs. 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 for sharing and benefiting from knowledge advances, especially in an era where more than half of Webpages are in English, which may eventually lead to a loss of cultural diversity and a loss for humanity (and perhaps a gain in mass communication and modernization -westernization).

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

Amongst indigenous knowledge, mythological knowledge determine life-long beliefs and lifestyles and is often linked to the spirit of the dead (pan-vitalism) through temple-less ancestors worshiping, veneration, divinizing, cult and reverence for ancestors’ sacred places and environments. All this is closely associated with the world of death, after death and the spirits and closely associated to the environment through the preservation of the land of the ancestors. Many Africans organize their lives by following the guiding beliefs and principles of animist or similar knowledge. This keep 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 to adopt the environment. For them the natural environment is god.

On the other hand, the evangelization and islamization of knowledge, which influence the lives of a majority of Africans, is impacting and transforming 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. Attitudes like these have, perhaps, contributed to the economic successes and the environmental failures of the industrialized 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 islamization of knowledge has transformed the Sahel, the Magreb and the Horn 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 in the heart of Islamic Africa (Darfour) can also be seen as environmental (eco-socio) 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 hominization (bipedization, juvenilization, cerebralization, manualization) and humanization (languagization, fire domestication, etc.). *Homo sapiens* (scientist) and *homo faber* (technologist) were truly Africans. And the best of *homo mythologicus*, *aestheticus*, *ludens*, *poeticus* and *consumans* is also African. In neolithic times, Africans had already developed rich empirical, logical, rational and analytical knowledge and developed powerful pre-scientific knowledge, which was really advanced in relation to previous knowledge. This pre-scientific knowledge was based on extensive botanical, zoological, ecological, pyrotechnical, geological, mechanical, architectural and operational knowledge.

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 continue to excel in many areas, such as in science, where Africans are earning international recognition; music and dances, where they are performing in festivals all over the world; in cinema, literature, theater and painting, where they win international prizes; in food, where couscous, *injera*, etc., are found in every major agglomeration of North America and Europe; in sport and athletics, where many rank among the best in the world as demonstrated again in the Athens Olympic; in creative hair styles, where African knowledge is being copied outside the continent. In businesses, where they excel more and more. Its creativity can be transformed into more economic wealth and provides the basis for initiatives related to sustainable development.

3 Knowledge Transition and Adaptation

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

More than half of Africa is not transiting toward sustainable development and is not likely to be shaken out of its lethargy anytime soon in 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). Key MDGs are not likely to be met for a very long time according to UNDP⁹.

These outlooks are perhaps too pessimistic for the slowly but steadily developing components of AKSs and perhaps too gloomy for its apparently knowledge-deprived non-developing components. 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. Relevant development knowledge is more accessible. Increased investments in many development areas, such as in 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) and the Commission for Africa (CfA), which is promoting good measures to alleviate financial (debt and aid) and subsidies burdens, will probably produce positive impacts on economic growth and social progress only 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 more challenging and pessimism is amply justified. Money cannot buy a culture of knowledge and the socio-economic transformations that are necessary for the transition to sustainable development. New ways at looking at the fundamental causes of the development problematic are required.

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 obsessive and impulsive knowledge. This is necessary for dramatically increasing the contribution of scientific, technological and technical knowledge. Indeed, scientific knowledge is increasingly required for understanding, developing and managing (Little, 2002) terribly complex human-environment systems, such as infinitely intricate African systems, which are embedded in a highly unbalanced, unjust and unsustainable larger global system. And technical and technological knowledge – a technology can be conceptualized as 'applied knowledge' or as a 'materialized knowledge system' (Millennium Project, 2004) – is required for addressing the acute environment, poverty, hunger¹⁰, health and unemployment nexus of crises that plague large parts of the continent.

Knowledge is presently revolutionized by the development of a global artificial cerebrality fueled by a growing planetary information and communication system¹¹ and economic liberalization and globalization. This knowledge revolution (de Ferranti, (2002) can accelerate and sustain the transition to development, which requires more effective, empirical, logical, technical, analytical, humanistic and rational knowledge and less impotent, outdated, occult, hermetical, orthodox, doctrinaire, mythological (Mbiti, 1990), anachronistic and prophetic knowledge. But before all it requires obsessive and passionate (Pfeffer, 2000) knowledge that can excite religious fervor and mobilize energies and effort.

3.3 A 'Passage obligé' to sustainable development (knowledge transition)

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 realizing the transition to sustainable development. They may also be the only real antidote against archaic mythologies, ideologies, superstitions, prejudices, 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 marginalized societies.

Yet, superior development knowledge remains the answer and the way out to Africa's multiple crises. It is a '*passage obligé*' to sustainable development. This *passage obligé* also requires that obsessive knowledge pervades the relatively young African population, who is more exposed and prone to social and cultural changes than their parents and grand-parents. Average life expectancy of AKSs is about 47¹² while life expectancy in IKSs is above 75¹³ - a 28 years difference. Median age in AKSs is 18.3 versus 38.9 in IKSs (Western Europe) - a huge difference (more than double)¹⁴. In addition, life expectancy has been declining in many AKSs¹⁵.

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; because they are not attracted by or fear modernization; because modernity (Lyotard, 1991), which is inaccessible on a global scale, appears to be totally out of reach; because of a generally oppressive and highly conformist culture; because they are jealously attached to century-old traditions; or because they are religiously pursuing the myth of salvation and immortality promoted by overwhelming and growing human and physical infrastructures, including social and media machineries¹⁶.

In this context *homo economicus* may be largely recessive. Nevertheless, the sound management and application of scientific and technical knowledge (OECD, 2000) possibly constitutes the greatest agent of change (Argyris, 1993) - a producer of food, health, wealth, jobs, and human progress - and at the opposite, its non-application, may constitute the greatest producer of social and cultural rigidities (Holden, 2002), poverty, stagnation, regression¹⁷ or unsustainable development. Scientific and technical knowledge can provide a hope for many African countries whose human indexes are deteriorating.

3.5 African economies in need of transformation (knowledge conversion)

A better and more intensive utilization or re-utilization (Markus, 2001) 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- comprising all knowledge relevant to sustainable development - and AKEs to be much 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 (WorldBank, 2000) 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 and eager population.

Most African countries have failed to redesign and modernize their traditional farming systems, methods and practices to meet local needs and face up international competition. This is having negative impacts on other sectors, such as education, health, labor, the environment, 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 realized at the regional level if it is being substantially realized 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 for its own interest. In a world where cars continue to shed billions of tons of pollutants into the air year after year, where water, forests, lands and biodiversity continue to be degraded¹⁸, 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 practicable development paradigm at hand, a paradigm capable of bringing about the radical changes that are needed to achieve a prosperous or decent and sustainable livelihood for everyone. Regardless of a lopsided process of globalization of knowledge, Africans, in cooperation and partnership with the industrialized 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 it drives modernization - a myth pursued relatively successfully by more than a quarter of Africans, particularly those from the well-connected, entrepreneurial and opportunistic urban quarters. It is mostly euro or americano-centric and its relevance for African development has to be assessed on a sector by sector or a case-by-case basis.

Only a tiny fraction of the potential of modern knowledge is utilized but its use is growing. It needs to be discovered, cultivated, harvested and promoted more vigorously for socioeconomic transformation. It emerges mainly from the release of the power of questioning against traditional forms of thought, which could be encouraged throughout AKSs for removing obstacles to modern knowledge generation (Godin, 2000), acquisition¹⁹, dissemination (Altbach, 1998) and diffusion and for transforming deficient knowledge edifices into efficient ones.

4 Knowledge Innovation and Globalization

4.1 Knowledge flows and globalization (knowledge circulation)

Knowledge flows and the globalization 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 two thousand years ago. Arabs and Chinese brought oriental knowledge by trading on the West Coast of Africa for centuries. Indonesians colonized Madagascar.

In term of development knowledge cows originated from the Middle-East *circa* 9000 Before Christ Era (c. BCE); knowledge of wheat, barely, sheep and goats were introduced into Africa 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. 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, cucumber, kidney bean, corn, eggplant, potato, sweet potato, cassava, tomato, pumpkin, groundnut 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 is coming into the region through a variety of mechanisms, including the Internet. The globalization 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 is bringing modern - if not the latest - knowledge into AKSs. It is estimated that 130,000 Africans are studying in industrialized countries²⁰. Still the number of agricultural researchers per million agricultural workers, for example, is around 42 in Africa and around 2,400 in industrialized 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 Africanization 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 of AKSs. South Africa (as well as South Korea) may offer a best practice in this area. Industrialized countries have a responsibility to

formulate and implement policies for maximizing the contribution of this knowledge to the development of AKSs. 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.

NGOs are also bringing some knowledge into AKSs that is useful for sustainable development. Most are doing a good job, particularly those working in the area of humanitarian relief, democracy, education, health, energy, human rights and gender issues. Recently, critics of the work of some NGOs have become more serious, particularly toward those that have ventured into areas such as economic policies, globalization, 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 machinelike religious incantations until, in extreme cases, it possibly blemishes or tarnishes his or her mind, psyche, mentality and intellect or damages his or her knowledge acquisitive and creative ability. Indeed, statistics show that receiving a Christian or Islamic education invariably leads to being a Christian or a Moslem for life - the equivalent of a life sentence. To avoid possible abuses, religious teaching methods could be regulated through the African Charter of Human Rights. A more balanced education, open to a diversity of faiths, myths, philosophies and ideologies (including 'Buddhist economics'), may be required to achieve sustainable development.

4.3 Licensed, leased, outsourced knowledge (knowledge utilization)

Licensed knowledge (knowledge used against royalty payments) is very low, concentrated in a few sectors and a few countries (particularly RSA – the knowledge hub of AKSs). This very low level of utilization reflects the low capacity of AKSs to use this kind of knowledge for their 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 for the use of the knowledge associated with the technology. This approach did not succeed because these royalty payments must be negotiated on a case-by-case basis. Industrializing 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 expatriates knowledge workers – a relatively small number by any standards - reflecting AKSs' 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 AKSs 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 AKSs.

4.4 Drained and foreign knowledge (knowledge patriation)

An estimated 20,000 professional knowledge workers (such as doctors, nurses, teachers, engineers, scientists) are leaving AKSs every year and more than half of foreign born students who get doctorates in the United States stay in the United States. It is estimated that 30,000 Africans holding a Ph. D. are working outside Africa. These numbers are likely to remain high and even increase, as industrialized countries need to attract knowledge workers to compensate 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 AKSs is also coming through partnerships (complementary knowledge), joint ventures and FDIs. In many cases there is no other alternative to these knowledge acquisition mechanisms. There exists an abundant literature and numerous meetings have been organized on these transfer channels. FDI can and must be strengthened for the benefit of both the transferors and the transferees. Many African governments have not opened a number of important sectors of their economy to FDI, such as banking, insurance, communications, agriculture and others. An important issue here is not only to attract efficient and competitive knowledge but also to promote ways to internalize this knowledge. Africa can acquire a lot more knowledge from the Diaspora, FDI, partnerships and joint ventures through adequate policies than it is the case now.

4.5 Intelligence gathering for modern development (knowledge prospection)

“Spying” for knowledge – legal or illegal - has been practiced since time immemorial and is still practiced today by many governments and corporations. It is a *cliché* that in the 1960s legions of Japanese armed with cameras scanned the world in quest of industrial knowledge. The Russians used their network of embassies to do the same. Most industrial countries and industrial corporations practice some forms of industrial intelligence gathering through various means, some of which gives rise to frequent lawsuits or expulsion of diplomats for activities incompatible with their status. African countries on the other hand are not practicing ‘espionage’ to acquire knowledge useful for their development. Perhaps there is a need for African embassies to focus more on commercial activities and on 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 proportion are ever empowering the most advanced knowledge economies, leaving large parts of Africa behind (The RSA is a special – more advanced – case). Surely, in spite of important progresses, many knowledge-poor or knowledge-deficient Africans remain currently relatively incapable, un-innovative and uncompetitive (Lall and Pietrobelli, 2002) in many areas critical for their development even if the African ingenuity, cleverness and 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. 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 mist of a global knowledge race (knowledge competition)

In a rapidly changing geography of knowledge and a highly competitive world environment (Jackson, 2003), AKSs 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, mobiles, computers, etc). This requires huge efforts and investments that are often beyond the means of a 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 an ever-growing global competition. In fact, AKSs are being involuntarily drawn into a global knowledge race (Otsuki, 2000), which they may lose for lack of effective knowledge strategies and policies.

4.8 Knowledge under-production (knowledge generation)

The knowledge race is real and poor performance is having negative consequences. One of the main knowledge issues in development policies revolves around the fact that AKSs are not generating by themselves much new knowledge for development, although the African adventure is a source of inspiration for current generations in respect to innovation and new knowledge. Knowledge creation through research and development is an understaffed, under-equipped, under-funded activity (less than half a percent of GDP compared with more than two percent 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 and it leads to little 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 centers in AKSs, which are useful for creating, learning (Rowley, 2000), assessment, adaptation, dissemination, demonstration and for 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 'tsunami' 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 (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-governance²¹, e-education (Sallis, 2002),

e-medicine, e-commerce, etc.), a robust global research system, a neo-liberal free market ideology and trillions of dollars of profit-seeking investments, it is fueling a growing planetary knowledge system in which Africa, in its diverse parts, is entangled, buoyed and integrated or marginalized.

The unfolding megawave of new knowledge, which has been labeled by the United Nations Development Programme (UNDP) the 'Knowledge Millennium', can provide 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 policymakers could pay more attention to and make more effort to emphasize the centrality of knowledge for sustainable development and to seriously face the challenge of making the most of knowledge opportunities that are arising (McCampbell, 1999).

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, poetical, 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 is increasing exponentially and is forcing all disciplines to fragment into an increasing number of specializations and narrow expertise, with knowledge monopolies and privileges.

In this context the ever-growing process of division of labor is producing ever more specialized knowledge, understandable 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. Science and technology also needs to be better integrated at regional level. A large proportion of research in Africa, for instance, is funded by international and bilateral donors who operate at national levels, in partnership with national governments. There is a need for a common regional agenda and regional integration programs, such as those promoted by NEPAD, which is providing excellent leadership in this area through the promotion, among others, of an African Science Foundation.

5.2 Managing critical knowledge challenges (knowledge negotiation)

The fragmentation, disciplinarization and professionalization of knowledge can be partially overcome by integration processes, which can be facilitated by the appointment of high profile and highly credible and respected Chiefs Knowledge Advisers (or Science Advisors) (CKAs), as chiefs knowledge development strategists, whose mandate would be to assess knowledge strengths, weaknesses, failures, shortcomings and opportunities, develop knowledge indicators, evaluate the knowledge landscape and the 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 centers or centers of excellence) and media, promote training of specialized knowledge workers²² (Davenport, 2000), develop new mechanisms for knowledge acquisition and trace possible knowledge futures. CKAs could also organize 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 centers (knowledge defragmentation)

The setting up or the strengthening of institutions and activities such as technology incubators, science parks, seminars, conferences, user groups, forums and networks (Echeverri-Carroll, 1999) can also promote knowledge integration processes. Political Committees, such as Parliamentary Committees on Science, Technology and Innovation (PCSTI), already in existence in a growing number of African countries, interdepartmental coordination forums, such as Science, Technology and Innovation Forums (STIF) can be extremely useful for sharing and defragmenting knowledge. Design teams on the African Green Revolution 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, 2000), including socioeconomic and political innovation, could be accelerated. Scientific literacy could be raised significantly. Scientific associations, knowledge communities and Community of Practice (CoP) (Hildreth, 2000), learned societies, guilds²³ 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 knowledge institutions could be strengthened or upgraded. AKSs are not producing much patented knowledge, or other forms of protected development knowledge, and some of this patented knowledge is not exploited, which reflect difficulties of application, in addition to difficulties of creation, due to un-enabling 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, 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 AKSs (25 - 40%). Perhaps there is a need for establishing more programs that will help these knowledge workers (Cortada, 1998) to get their first job on the labor market, in line with similar programs in industrialized countries. Perhaps there is also a need to help university and college graduates to create their own jobs. The idea is to minimize loss of useful

knowledge for development. Knowledge that is not used (and updated) is likely to deteriorate. Only massive jobs creation can solve the problem of idle knowledge workers.

5.6 Privatized knowledge (knowledge appropriation)

Privatized 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 privatized by multinationals, corporations, research organizations 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 centers and where all the knowledge generated was made available for developing countries. This evolution puts AKSs at a disadvantage since they are not generating much the new knowledge that they need for their progress and since they are reluctant to pay royalties for knowledge. It raises a number of issues related to the private property aspects of this knowledge and its impact on development. Good initiatives have been launched to make private knowledge more accessible.

The African Agricultural Technology Foundation (AATF), for instance, is dedicated to identifying and facilitating royalty free acquisition of proprietary knowledge and technologies through negotiation and entering into contractual agreements with existing institutions that will manage deployment of the technologies and the related technical knowledge. Privatized 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 organizations in AKSs capable of generating new knowledge. Perhaps the Consultative Group on International Agricultural Research (CGIAR) system, re-centered on African needs, could acquire some of this private knowledge and redistribute it freely to knowledge seekers and users.

6 Knowledge Constellation and Clusterization

6.1 Packages of Green Revolution knowledge (knowledge agglomeration)

An emphasis could be put on promising clusters of scientific and technical knowledge (McCormick, 1999) and on exploiting these clusters for mission-oriented development (Maskell, 2001). Green Revolution design teams, for instance, could be setup, among other things, to develop various packages (Bednar, 1999) of scientific, technical (agricultural) and organizational knowledge (Sanchez, 2001) that is 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 the lowest in the developing world, standing at only 42 percent of that in Asia and 50 percent of that in Latin America. The productivity of agricultural labor is also very low, amounting to less than 60 percent of that in Asia and Latin America.

An AGR will increase agricultural productivity (Thirtle, 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, 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 ECA 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-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 micro-design (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 for the provision of the necessary inputs and for agro-processing; the development of markets for agricultural outputs; sustainability concerns; and the progressive globalization 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 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, genomics - has opened up all sorts of possibilities for contributing 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 for designing and fashioning 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 performance of the resulting products.

The application of biotechnology could fashion plants that are more drought resistant, more resistant to pests, 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 for 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 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 it 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 more to the AGR and to the larger sustainable development effort (Woytek, 1998). It can also hinder this effort. It is sustaining the subsistence of a good number of Africans and is geared more toward 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 be holding back development.

More attention could be paid to antique, tacit (Leonard, 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, analyze, validate, codify, protect and exploit this knowledge to the fullest extent possible.

7 Knowledge Demythologization and Remythologization

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

Mythologies hypnotize 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 of invading 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 a certain 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, spirits, angels, archangels, guardian angels and devils. It is full of myths, such as divine conceptions, immortality (pharaohs), after-lives, guiding stars, annunciations, miracles and salvation – mythologies that predate Christianity.

These mythologies are kept alive with extensive rituals and celebrations. Mythological indigenous knowledge, on the other hand, is filled with deities, spirits, superstitions, fallacies, fictions, specters, phantasmagorias, chimeras, misconceptions, confabulations, palavers, fantasies, and ancient cults, rituals and taboos. 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 to developing countries but African mythologies, whether imported or home grown, are not helpful for bringing about a scientific culture and is – under certain conditions - quite useless, if not counterproductive, to achieve sustainable development. It is useless, for instance, for competing with China in low-tech industrial goods, the main industrial competitor of Africa. There is an urgent need for de-deifying 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 influences the collective psyches, behaviors and development of many Africans. Indeed, Evangelical²⁴ and *Qur'anic*²⁵ knowledge, for instance, promoted by ubiquitous knowledge centers (churches and mosques), 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 and actions on speculative knowledge for life-after-death (Wiredu, 1992) and on irrelevant and unproductive knowledge for sustainable development. It is worth recalling that when Christianity conquered the Roman Empire in the 3rd century it precipitated Western civilization into a one-thousand years decline and when Islam conquered large parts of Africa in the 8th century it kept them somewhat frozen, in many fundamental aspects, one thousand years in the past.

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 utilization of feminine talents, ingenuity and knowledge; affection and care for nature; a concern for the future; superiority of scientific knowledge over saintly scriptures; and a focus on life before death²⁶ – all necessary conditions of knowledge-enhanced sustainable development. Indeed, an emphasis on life before death and an emphasis on relevant and reliable knowledge for sustainable development could save millions of lives. Vigorously promoted by a pervasive and expanding physical and human infrastructure²⁷ - not exactly a fountain of fresh knowledge - this knowledge, in many circumstances, constitutes a virtual owners' 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), particularly intense in many parts of AKSs (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, illiterate desert tribes, may be less and less relevant for the governance of the complex globalized, knowledgeable world of today. There is a need to demythologize / remythologize the African knowledge landscape. This is the most daunting knowledge challenge.

7.4 Faith-based knowledge could be desacralized (knowledge de-fetishization)

Desacralizing and de-tabooing inefficient, fetishistic and untouchable knowledge can go some way to 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 of another institution, be indoctrinated with anti-development knowledge, be irresponsible for his/her own knowledge choices or consider his 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 religious beliefs in politics or be persecuted for choosing his or 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 doubtful 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 faith-based 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 who 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 marrying or for acquiring nationality.

8 Knowledge Emancipation and Liberation

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

Un-innovative economies are typically the result of knowledge stagnation and fossilization, 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 the 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 right to the 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).

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

In line with these rights, sustainable development could require that Africans be born free. Simply born free. Free of being born as an 'Ancestor', a Christian or a Muslim. Free from a blind lottery. Free from the myth of the spirits and ghosts. Free from the myth of salvation and immortality. Free from the myth of modernity. Free from cultural prejudices. Free from social intimidation, persecution and conformism. Free from knowledge manipulation, repression, contamination, illusion, monopolization and pervertization. Free from sectarian education. Free from ghettoizing (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 non-family men, etc.). Free from illiteracy. Free from obscurantism. Free from irrelevant relics of long-gone societies.

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

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

8.4 High road to knowledge age requires revolutionary knowledge (knowledge mutation)

Knowledge emancipation also requires that African be free from the Bastille of self-deceptive knowledge. Free from obsolete knowledge. Free from knowledge pathologies, anemia and asphyxia. Free from hallucinatory, schizophrenic, hysterical, genocidal, infirm, anemic, shortsighted, impotent and debilitating knowledge. Free from excessively ego-socio-ethno-chronocentric knowledge. Free from pedant elitist knowledge. Free from controlled, enslaving, fossilized, fractured knowledge. Free from hermetic, incapacitating, irrelevant knowledge. Free from untouchable, sacred, mediocre and junk knowledge. Free from spam. Free to choose and use critical, revolutionary (Allee, 1999), dissident, subversive knowledge. Free to focus on relevant, effective, rational and strategic knowledge.

9 Conclusion: Knowledge Progression and Evolution

9.1 Scientific mentalities for knowledge reforms (knowledge revitalization)

What is needed is not so much the growth of the stock of scientific and technical knowledge, not so much encyclopedic and scholarly knowledge, but the development of scientific thinking and of scientific mentalities. The new ways of thinking and the new mentalities are more important than the new knowledge to achieve a meaningful transition to sustainable development in the context of a mythological, more fraternal, more just, more equal, less fractured and sustainable world society. In this context, African knowledge could evolve in many directions to contribute more to sustainable development. It could evolve toward knowledge that is more autonomous (free thinking knowledge), strategic (knowledge aiming at sustainable development), radical (fundamental, critical, outside-the-box knowledge) and rational (coherent with the North Atlantic techno-scientific paradigm).

It could evolve toward knowledge that is more competitive (to benefit from regionalization and globalization), more universal (knowledge valid across tribes, ethnic groups and cultures), more tolerant (open to deviant, heretic knowledge), more trans-disciplinary (comprehensible across professions) and more sustainable (resistant to time and generations) knowledge. It could evolve toward knowledge that is more imaginative, inventive, creative and innovative. It could evolve toward knowledge that is more utilitarian, instrumental, functional and operational. The alternative is to keep trying African development with somewhat non-performing knowledge portfolios of relatively inefficient, redundant, 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 of conceptual self-exorcism (knowledge decolonization / 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. 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, endemic, traditional knowledge. It could prevail over ancient Judaist knowledge (from which evangelical and *Qur'anic* knowledge is derived). Doubting and criticizing is the key to wise, flowering and powerful revolutionary knowledge. Perhaps only deviant, disobedient and dissident African thinkers can deracinate some fossilized, ineffective and unproductive knowledge that keeps half of African countries necessitating food aid and assistance.

9.3 Investments 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 AKSs 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 ultra-complex transition to sustainable development. This raises tremendous 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 knowledge performance.

9.4 Knowledge lovers could spearhead knowledge culture (knowledge acculturation)

How can Africans be free to realize a true knowledge revolution? Free to take the high road to the knowledge age? Free to embark on a new journey for knowledge-enlightened sustainable development? Freeing AKSs from deficient knowledge bases for sustainable development could mean supporting and promoting non-compromising 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 knowledge competences (Lall, 1992) and knowledge rights. It could mean removing a host of obstacles to knowledge acquisition, production (Machlup, 1962), revision and circulation. It could mean finding a more profound and meaningful communion with the essence of reality. It could mean playing the politics of knowledge more forcefully (Cohen, 1992). It could mean opening and exploiting new critical knowledge avenues. It could mean encouraging and sponsoring knowledge-based employment-creating enterprises (Rogerson, 2001). It could mean evaluating and planning the steps and processes that will transform existing organizations into "knowledge-based" organizations (Liebowitz, 1998). It could mean cultivating a knowledge culture (Knox, 2004). It could mean inventing a new knowledge future.

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

African freethinkers, knowledge elites, knowledge leaders and knowledge organizations, could intensify their work toward evolving trans-cultural, trans-social, trans-ethnic²⁸, trans-religious and trans-historical knowledge (jettisoning excess baggage). They could focus their work more on demythologizing / remythologizing the African continent with some possibly more relevant and less detrimental 'gaseous' knowledge and transform knowledge portfolios into more effective ones for knowledge-engineered sustainable development. Scientific and technical knowledge must play an important role in this endeavor. 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 AKSs from the shackles of mythological non-development or anti-development medieval and ancestral knowledge is a major development challenge that cannot be faced without a decisive contribution from powerful scientific and technical knowledge.

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

Meeting this knowledge challenge could mean designing policy orientations that consecrate knowledge as the most significant resource for sustainable development. It could mean launching and capitalizing on a number of processes to reform, improve, crossbreed and strengthen knowledge, such as: uncovering, identifying, stocktaking, recording, describing, detribalizing, testing, analyzing, validating, codifying, protecting (Burch, K. 1995),

patenting (Mgbeoji, 2001), hybridizing, de-charlatanizing and exploiting endemic, indigenous, traditional or local knowledge. It could mean rethinking, questioning, criticizing, demystifying, de-deifying, de-fetishizing, desacralizing, de-spiritualizing, de-prophetizing faith-based orthodox medieval knowledge. It could mean auditing, deinstitutionalizing, decontaminating, secularizing (African Creation Myths, 2004), opening, ‘decolonizing’ (Wiredu, 1992) and modernizing this knowledge.

It could mean producing (creating / generating), sharing, harvesting, cultivating, diffusing, democratizing (Haynes, (2004), ‘Africanizing’, ‘indigenizing’, ‘scienticizing’ and internalizing various types of modern knowledge. It could also mean re-engineering, enhancing, valuing, thermodynamizing (hot bubbling knowledge culture), feminizing, rejuvenating, leveraging (Carayannis, 2000), emancipating, liberating, integrating, popularizing 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 and technical knowledge, 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 labeled 'culture'.

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

³ Such as sylligraphic system (Ethiopic Writing System -Geez, Afan-Oromo Script, Amharic Syllographs, Ethiopic System w/ Numeric Values, Mende Script, Nsibidi, Vai Syllabry, Shumom Writing System); alphabetic system (Bassa script); pictographic (Egyptian Writing System, Meroitic Script); Chromatographic (based on color) from Ghana and Niger (Source: Africana Library, Cornell University).

⁴ Examples of symbols that resonate across AKSs include woman: symbol of peace, productivity, creativity, life and growth; the elephant: symbol of power and kingship; the lion: symbol of ferocity, danger and royalty.

⁵ Magic is derived through acting with objects and words to conquer fear, predict the future, cast curse, fill wishes, heal, etc.

⁶ Rock art in AKSs are found in Algeria, Southern Morocco, Libya, Niger, Chad, Mauritania and South Africa (Africana Library, Cornell University).

⁷ 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.

⁸ An example of African proverb related to knowledge: 'He who knows all, knows nothing'.

⁹ According to UNDP, as of mid-June 2004, if present trends continue, Africa will meet the goal of reducing poverty by half (a MDG goal) by 2147 !

¹⁰ One African out of three (in sub-Saharan Africa) is food insecure and half of African countries need food aid.

¹¹ The development of ICTs in Africa represents perhaps the greatest development successes in recent years in support of knowledge access and dissemination.

¹² Figure for sub-Saharan Africa in 2000 (Official UN Statistics on Population).

¹³ Average for Europe, North America, Australia, New Zealand and Japan in 2000 according to Official UN Statistics

¹⁴ Official UN Statistics on Population.

¹⁵ Life expectancy in Zimbabwe plummeted from 56 years in 1970-75 to just 33.1 today. Zambia went from 49.7 years to 32.4 in the same period, Lesotho from 49.5 to 35.1, and Botswana from 56.1 to 39.7.

¹⁶ Egypt's Ministry of Religious Affairs, for instance, plans to connect some 5,000 mosques with 10,000 loudspeakers, all blaring at once five times a day, to call people to prayers. In some African countries religious organizations own or rent entire TV channels for televangelists.

¹⁷ In the 1990s fourteen African countries saw a deterioration of their human development indexes: Botswana; Burundi; Cameroon; Central African Republic; Congo; Dem. Rep. of Congo; Côte d'Ivoire; Kenya; Lesotho; South Africa; Swaziland; Tanzania; Zambia; Zimbabwe.

¹⁸ More pollution, contamination, degradation, depletion, extermination, destruction, division can be expected on the global scale according the current trends analyzed by the WorldWatch Institute.

¹⁹ The World Bank identified three key means of facilitating the acquisition of knowledge from abroad: an open trading regime, foreign investment and technology licensing.

²⁰ In OECD countries.

²¹ 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.

²² The concept of knowledge worker was first formulated by management guru Peter Drucker in the 1960s.

²³ A descriptive term for an organized group of suppliers of a specific kind of knowledge. Knowledge Guilds guarantee a level of quality in business interactions with their members.

²⁴ In the last two decades there has been a recrudescence of proselytism originating from America and the Arabic peninsula. Thousands 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.

²⁵ 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, Northern Chad. In West and East Africa the Sufi Brotherhood dominates, especially in Senegal, the Gambia, Niger, Mali, Guinea, Kenya and Tanzania.

²⁶ This observation is based, among others, on the author's personal visit to more than 700 African households during the last 31 years.

²⁷ 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.

²⁸ 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.