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Sustainability of Africa through technological innovations and indigenous knowledge systems: a discussion of key factors and way forward

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ABSTRACT

Contemporary African development is imposed through globally (internationally) benchmarked educational, technological and economic systems principally steered by the Industrial Revolutions (IR). IR prepares Africans to predominantly serve sustainability of foreign economic and therefore educational interests. Africa is thus academically detached from the local developmental challenges, this leading to the current psyche of negative narratives about Africa as a third world continent of charity deficient of own knowledge systems. It is argued that Africa's ability to develop sustainably is linked with its ability to secure its environment whilst adding value to its resources and this will be enhanced by the adoption and inclusion of African values including some of its philosophical fundamentals such as Obuntubulamu (Ubuntu). A hybrid of Obuntubulamu as a philosophical fundamental among Bantu in Africa and the contemporary global development models could be an alternative pathway to salvaging African development. This follows on the observation that valid African discourses and paradigms such as Obuntubulamu enhance the research capacity and knowledge to develop Bantu communities as well as their Indigenous Knowledge Systems (IKS) (Mwanga-Zake, 2017). In trying to bridge the gap between IKS and international development models, the authors use a perspective lens to propose frameworks that are appropriate to capture IKS and technological epistemic knowledge practices and provide highlights on the perceived paradoxes. The authors simultaneously discuss how these can be managed to improve sustainable development in African societies. The proposed paradigm deliberately shifts participation towards Higher Education Institutions (HEI).

KEY TERMS: Africa, development, higher education, indigenous knowledge systems, Obuntubulamu, sustainability, technology, Ubuntu.

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INTRODUCTION

A generally commonly held understanding of IKS is one from Cosijn, Pirkola, Bothma & Jarvelin (2002: 94) and The World Bank (as cited in Chisenga, 2002: 1) that IKS is local and unique to a society. This understanding evolves. Thus, more recently, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), (2021) emphasises that, in practice and belief, IKS is dynamic, integrated, holistic, social and ecological. IPBES concludes that IKS/ (Indigenous and Local Knowledge (ILK) is:

The knowledge, practices and innovations embedded in the relationships of Indigenous Peoples and Local Communities to nature. ILK is situated in a place and social context, but at the same time open and hybrid, continuously evolving through the combination of written, oral, tacit, practical, and scientific knowledge attained from various sources, and validated by experimentation and in practice of direct interaction with nature.

In this paper, IKS refer to local skills, understandings, philosophies, technologies and knowledge that are unique to a particular community. IKS inform decision-making about fundamental aspects of day-to-day life such as agriculture, natural disaster management, food security and climate change. This paper focusses on Indigenous Knowledge (IK) in Africa; especially sub-Saharan Africa, which is mostly habited by Black Bantu people. In this part of the world much of the IK remains tacit, sacred and embedded in practices, relationships and rituals (Cosijn, Pirkola, Bothma, & Jävelin, 2002: 1; Bhola, 2002: 10). IKS are outcomes of generations of diverse cultures along with their observations, experimentation and lived experiences in the natural African environments. It is argued in this paper that Africa's ability to commercialise its innovations and add value to its resources will be enhanced by the adoption and inclusion of African IKS including some of its philosophical fundamentals such as Obuntubulamu (Ubuntu) into education, research and development policies.

From the above, a key aspect of IKS that requires focus is its nature to evolve. Its dynamism implies the ability to adopt or acquire technological advances, although IKS are abundantly burdened by the myth of unpractical and impractical applications in contemporary lives. Localising is nonetheless very pertinent to African development. There is a need to enhance positive synergies and to identify trade-offs and connections between all knowledge systems.

AFRICAN IKS AND ITS IMPORTANCE AND CONCERNS

Cosijn, Pirkola, Bothma and Jarvelin (2002: 94) and The World Bank (as cited in Chisenga, 2002: 1) refer to indigenous knowledge as a body of local knowledge and skills unique to a society. The authors are focussing on Indigenous Knowledge (IK) in Africa; especially sub-Saharan Africa, which is mostly habited by Black and specifically Bantu people. In this part of the world much of the IK remains tacit, sacred and embedded in practices, relationships and rituals (Cosijn, Pirkola, Bothma, & Jävelin, 2002: 1; Bhola, 2002: 10). African IK might not easily fit into is the traditional Western disciplines because it is integrated (holistic). Unfortunately, the social anthropologists' studies of local knowledge were and still are *framed by theoretical and colonial-administrative concerns* ... (Leach & Fairhead, 2002; 309) reflective of western understanding and happenings.

Some concerns of African IKS

African IKS inadvertently presents inconsistencies in African philosophy and knowledge because its tacit. Tacitly knowledge inhibits its transformation. Thus, African IKS is consistently and efficiently becoming compromised and mute. Indeed, much of the African IKS have been and continue to be controlled through Western epistemologies and ontologies (Mekoa, 2015). Fortunately, the holistic and community-based nature of IKS provide a foundation for a link between researchers and IK holders and practitioners in local communities. This is because the inter-multidisciplinary nature of IKS makes it uniquely receptive and relevant to local dreams, current discourse in African Renaissance, decolonization, transformation including cultural diversity. Hence, adoption of African IKS is compatible with foreign philosophies (Muwanga-Zake, 2009).

Indeed, some historical, political, ideological, institutional and structural obstacles against further development of IKS, and its innovations, has been abundantly observed (e.g., Mekoa, 2015), especially in Africa, where IK is largely misunderstood, deliberately distorted or even dismissed by development-planning experts, who label African IKS irrelevant, fetish and nonsensical. This is complicated, for example in a Ugandan context, and elsewhere, where a cocktail of Industrial Revolutions (IR) and multiple IKS co-exist, confounding the needed mapping out of technological and economic developments. The development trajectories might not easily be nationalised across a country given the multiple cultures and traditions.

Besides, inhibitors include computer-based/ information systemic innovations that are detached from the livelihoods of the potential beneficiaries. Thus, innovations hardly enhance economic development, and degenerate into a comma, which causes environmental degradation and exploitation of Africans.

MISALIGNED EDUCATION SYSTEMS IN AFRICA

The African values are deliberately and consistently becoming compromised and muted through formal education. Indeed, much of the African IKS have been and continue to be controlled through dominant foreign epistemologies and ontologies, suspiciously to exploit Africa's human and material resources. The desperation caused by misaligned educational systems and research in Africa is surreptitiously articulated in the lamentations of Ulimwengu (2013): *Indeed, despite political independence, African scholarship has failed ... and ... most often relying on the largesse of the big Western foundations, trusts whose agenda may be at variance with African interests.*

African education does not focus on critical issues in Africa. Nevertheless, alas, critical thinking and problem solving that would interest Africans does not relate with African IKS opting for, instead, foreign elitisms (Cutright, 2010), associated with Eurocentric quality of life (Blomquist, Coomes, Jepsen, Koford & Troske, 2009). Education is rarely integrated into endogenous development potentials (Ndoye, 2008: 70-71). This status is rooted in Africa's colonial history during which African ways were rejected as worthless by Westernised formal education (Mbow, 2003: viii). Above all, education does not even perfect the global standards due to lack of the resources required, mostly imported – the low international rankings of African Higher Education Institutions (HEIs) are indicative of continental HEIs trying without success to emulate Western HEIs. That is, African education systems engender tensions against the African public. Materu (2007) notes a public perception that educational quality is being compromised in the effort to expand enrolment in recent years; growing complaints by employers that graduates are poorly prepared for the workplace in Sub-Saharan Africa. Consequently, African Higher Education (HE) is an imperfect clone of HE of the former colonial masters (Alemu, 2014).

In villages around Nakaseke in Central Uganda, a simple survey shows that most of the graduates are useless and fail to impact upon the wellbeing of the public. So, graduates become unemployed, yet their parents sell their land and belongings to school those graduates. Joblessness and loss of resources lead to poverty. Hence, the public is slowly but surely realising that paying for formal education is impracticable and have lost confidence in education. The number of graduates produced upon internationally recognised curricula from African HE is apparently on the rise, but those graduates are unemployable in local communities. They are prepared for jobs outside Africa. In Africa, there are many indicators of educational or curriculum failures not limited to:

- Under- utilization of local resources due to curricula that are distanced from the immediate communities;
- Unemployment of graduates partly due to lack of curricula directed at harnessing local resources profitably;
- Research that grows foreign knowledge systems;
- Unrelenting attempts to adopt foreign already-made solutions, and;
- Knowledge, research and innovations that are isolated from local systems.

Often in Africa, researchers use foreign discourses and paradigms on a community, whose culture, language and context they hardly relate with or understand (Muwanga-Zake, 2018). Research dissertations and theses are defended against 'international' research methodologies. Research based on foreign paradigms yields knowledge and innovations that inadvertently control development in Africa, and permeate every African social, political and economic sphere. Research and innovations develop and extend foreign knowledge systems – we are in Africa awarded qualifications and are admitted to degrees in foreign knowledge. Yet, outcomes of research based on foreign institutionalised and universally applied paradigms external to the participants might not be as valid in Africa as we are made to believe. This view is supported by Fish's (in Lincoln & Denzin, 1994: 579) point that separate interpretive communities have distinctively unique standards or versions of verisimilitude as proof of truth or validity.

Foreigners through research have misinterpreted Africans and their needs, thus handing down to Africa what they perceive as development. African institutions have suffered a form of paradigm addiction and tend to live in a suicidal repudiation that they are perpetuating foreign paradigms at all, as foreign paradigms are equated to the survival of the educated and those employed to perpetuate foreign interests. Contemporary paradigms and discourses applied in Africa tend to diminish the indigenesness of data and needs, thus stamping upon African realities - instead such paradigms perpetuate selected truths, albeit distorted to be globally valid. Supporters then manipulate and control African societies in order to prevent any social or cultural advancement out of the status quo paradigm, ignoring or suppressing public knowledge of anomalies, equating perception of anomalies to personal abnormality in order to intimidate populations to remain within foreign paradigms. Thus, Africa today suffers stagnated economies that pose the challenge of researching Africa and her needs for development.

Humans everywhere generated and applied knowledge about their environments and how to harness resources for their wellbeing long before scientific inquiry and education were formalized. Indigenous peoples developed,

maintained, and evolved knowledge systems via direct experience interacting with biophysical and ecological processes, landscapes, ecosystems, and species over millennia (Atleo 2011; Berkes 2018). Thus, every human society has ways of acquiring, processing and disseminating knowledge in an attempt to address their peculiar problems. A global education system or central learning authority is invalid and unverifiable as it leads to the demolition of traditional sustainable (agricultural and ecological) knowledge, the breakup of extended families and communities, and in the devaluation of ancient spiritual traditions. Consequently, there is an increasing global and postmodern recognition as well as understanding of indigenous models of education as feasible and legitimate.

The forces against IKS in education are almost insurmountable because the dominant discourses and knowledge are deliberately imported to exploit Africa's human and material resources. This agenda is unfortunately largely led by the academia, research supervisors and publishers whose privileges to determine research paradigms, acceptable knowledge and epistemology, and to interpret research findings are hitherto conspicuously associated with and approved by foreign knowledge systems. Ultimately knowledge is destructive or is hardly applicable and beneficial to African environments and value systems. This is exacerbated by misinterpretation and misuse, almost everything African, including African IKS, that are designed to be antagonistic to non-African technical and economic innovations. These are partly responsible for the unsustainable paradigms in Africa. Thus, according to the United Nations Conference on Environment and Development in Rio (1992), sustainable development remained elusive for many African countries, with poverty being a major challenge and desertification, deforestation and climate change its main threats.

UN SUSTAINABLE DEVELOPMENT GOALS (SDGS) AND IKS

In attempting to mitigate that elusion, fast forward, the United Nations General Assembly adopted the 2030 Agenda for Sustainable Development titled "Transforming Our World: the 2030 Agenda for Sustainable Development" on 25 September 2015. The Department of Economic and Social Affairs of the United Nations includes 17 Sustainable Development Goals (SDGs) built on the principle of "leaving no one behind". The Agenda emphasizes a holistic approach to achieving sustainable development for all, including Africa. For example, Goal 9: Industry, Innovation and Infrastructure is among the 17 SDGs, envisaged by 2030. The same report contemplates possibilities to actively improve future prospects for action and progress by 2030 and beyond. One idea is to leverage scientific knowledge for promoting sustainable development through SDG and international interlinkages. Additionally, Section A/RES/70/1 of the 2030 Agenda calls for indigenous peoples' participation to an extent of setting 9th August as an indigenous peoples' day, annually. The Agenda notes that indigenous peoples are disadvantaged, partly due to exclusion from the mainstream technological and economic development projects.

International support for protection of IKS comes, *inter alia*, from the United Nations Declaration on the Rights of Indigenous Peoples 2007, which provides in Article 31 that Indigenous peoples "have the right to maintain, control, protect and develop their Intellectual Property (IP) over such cultural heritage, traditional knowledge and traditional cultural expressions." So, according to World Intellectual Property Organization (WIPO) which is the global forum for (Intellectual Property (IP) policy, services, information and cooperation, Traditional Knowledge (TK) and Traditional Cultural Expression (TCE) ought to be protected as a form of IP. This is because creators and innovators worldwide use IP to translate their ideas into assets. These properties create economic and social benefits that improve the lives of people everywhere.

Lately, and fortunately, the formulation of development assistance policies recognises the positive role that IKS can play in the success of development projects at a UN level. According to the UN, indigenous peoples and the Technology Facilitation Mechanism (TFM) allows for the inclusion of discussions on indigenous knowledge as an interface between the science-policy and the mobilization of science, technology and innovation (STI) for the achievement of SDGs. The cross-cutting nature of the SDGs and STI, multidisciplinary and integrated approaches were deemed necessary to take into account different sources of knowledge, including traditional knowledge, recognized as inherently encompassing most of the aspects and principles of SDGs.

These developments are outcomes of previous UN deliberations regarding indigenous peoples and knowledge, which started after 2015. For example, the MDG Report 2015 noted that "*Africa made great strides towards the eight Millennium Development Goals in many areas, especially related to health and education - the advance registered by Sub-Saharan Africa was the fastest among all developing regions.* At the STI Forum 2018, indigenous peoples participated in Session 7 "Realizing the full potential of local and indigenous knowledge, and homegrown innovations for the achievement of the SDGs" and discussed how local and indigenous knowledge contributes to the SDGs, and how indigenous peoples and local communities can build synergies between IKS and science to achieve the SDGs. Needs and gaps with regard to policies and partnerships in this area were identified.

The following year in the STI Forum May, 2019, indigenous peoples participated in Session 8 "Linking science, technology and innovation of indigenous peoples, culture and traditional knowledge, and the

achievement of the Sustainable Development Goals” and discussed how to find synergies between indigenous and traditional knowledge and local technologies relevant to the achievement of the SDGs; and also presented recommendations on how better to highlight and mainstream the role of indigenous knowledge. Fresh ideas and reports about IKS-technology integration were presented at the 2023 SDG Summit which was convened on 18-19 September 2023 in New York.

The opening sentence of the UN, Department of Economic and Social Affairs Sustainable Development website titled *‘Integrating Indigenous Knowledge Systems In 2030 Un Sustainable Development Goals’* states that ‘Increasingly, Indigenous Knowledge Systems (IKS) are being recognized as inherently encompassing most of the aspects and principles of SDGs’.

WHAT SHOULD BE DONE

You cannot develop people; people have to develop themselves, advised former president of Tanzania, Julius Nyerere. IKS are embedded in African cultures, which, unlike the imported education, is holistic and community-based. Taking heed of Nyerere’s advice, Africa’s IKS are key to Africa’s progress but demands integration in school curricula, research and innovations, with a focus on the challenges in African realities. Hence, new assumptions and expectations are needed in Africa that will transform IKS from tacitly to allow open debate and research. That is, new paradigms in which Africa is able to solve problems of the old paradigms should be created, to salvage African development.

An idea presented in this paper is to integrate technological innovations into IKS or IKS into technology. This requires policies for holistic co-ordination and collaboration of all stakeholders and resources in the IK system; particularly the key drivers for IKS support. It is obvious that IKS have to be documented to start with, and the documents ought to be foundations upon which public understanding of various components of IKS is built. As IKS is tacit, there is a need to work on legal processes and on IK policies of documenting, disseminating, whilst simultaneously protecting IK. Thus, there is an urgent need to create IK centres for each cultural group or region, and in each institution of Higher Education in which the following strategic goals would be pursued:

Curriculum development of IKS in educational institutions. IK should be part of the primary school curriculum and development programs (including business).

IKS in education

Mushi (2009) defines African indigenous education as a process of passing among the tribal members and from one generation to another the inherited knowledge, skills, cultural traditions, norms and values of the people. The indigenous education systems have to evolve into ways that can be integrated in formal education, or otherwise have to be recognised. Either way requires IKS centres of education.

IK centres should collaborate IKS to solve common problems. For example, one aim of indigenous education could be to ensure lifelong utilization, promotion, and enhancement of IKS beyond the standard authoritative Western school curriculum of reading, writing, and arithmetic (Merriam, Caffarella, & Baumgartner, 2007). Fortunately, on the basis of educational sociology, philosophy, and psychology, indigenous education allows an all-inclusive approach that guides learning toward broader view of the world including the contextual issues relevant to the immediate environment and sustainability. Traditionally, African indigenous education is community oriented, geared to solving the problems of the community. Indigenous education specifically focuses on teaching indigenous knowledge, methods, and content within formal or non-formal educational systems (Ogbo & Ndubisi, 2020). Therefore, IKS should be recognized through indigenous education methods as a response to the erosion and loss of indigenous knowledge through the process of colonialism, globalization, and modernity (May & Aikman, 2003).

In consideration of development, learning in indigenous education involves the entire community and so learning methodologies should be similar to the cultural norms in a community and be geared towards development. For example, indigenous learning styles often include: observation, imitation, use of narrative/storytelling, collaboration, and cooperation (Muwanga-Zake, 2018, 2009, 2007). African indigenous education puts emphasis on practical learning by watching, participating and executing skills like carving, masonry, clay working, cloth making, building and construction, cooking, and home management. These basic hands-on skills, direct experience, knowledge and attitudes enable inclusivity to live and function effectively in the society (Merriam *et al.*, 2007).

Ultimately, there should be training programmes and study materials on IKS for development workers in IKS, practitioners, educators and holders.

IKS to be part of government and institutional research, innovation and development departments

Objectivity is not the characteristic of an individual, and is inherently an anti-social phenomenon, especially in Africa. IK research instead should adopt knowledge advances by consensus and revision. Institutions of learning in Africa should accept methods of obtaining knowledge that are unconventional in terms of foreign-based paradigms, and insist that findings be built upon established IKS truths, thus re-affirming the IKS status quo in Africa.

IK is generally holistic and so interdisciplinary in terms the modern learning areas. So, research on IKS should be systemic in a way that is cost-effective and reliable. New philosophical approaches, incorporating methodologies such as *Obuntubulamu* (Muwanga-Zake, 2018) or *Ubuntu* (Muwanga-Zake, 2009), are inadvertently required, against the mainly scientific approaches such as objectivism in technology.

Obuntubulamu and dialogue: individuality and plurality

Obuntubulamu is inspirational and exposes a need to encounter the foreign paradigms that are against humanness (Sidane, 1994:8-9). That is, Africa needs to acknowledge the diversity of local economic resources, languages, histories, values and customs. In an attempt to encounter foreign research paradigms, Louw (2004) advocates of claims to truth or credibility, against absolutism. The absolutist evaluates other world views of criteria in violation of understanding IKS. The enforced homogeneity of norms and values transcends African IKS, which just surrenders the evaluation of beliefs and practices to mainly Western arbitrary subjectivities. According to Louw (2004), *Obuntubulamu* respect for the particularity of the other, links up closely to its respect for *individuality*. But, be it noted, the individuality, which *Obuntubulamu* respects, is not of Cartesian making. On the contrary, *Obuntubulamu* directly contradicts the Cartesian conception of individuality in terms of which the individual or self can be conceived without thereby necessarily conceiving the other. The Cartesian individual exists prior to, or separately and independently from the rest of the community or society. The rest of society is nothing but an added extra to a pre-existent and self-sufficient being. This "modernistic" and "atomistic" conception of individuality lies at the bottom of both individualism and collectivism (Macquarrie, 1972: 104). Individualism exaggerates seemingly unsustainable solitary aspects of human existence to the detriment of communal and aspects, characteristic of Africans. Collectivism makes the same mistake, only on a larger scale. For the collectivist, society is nothing but a bunch or collection of separately existing, solitary (i.e. detached) individuals.

By contrast, *Obuntubulamu* defines the individual in terms of his/her relationship with others (Shutte, 1993:46) and with the environment. According to this definition, individuals only exist *in* their relationships with others, and as these relationships change, so do the characters of the individuals. Thus understood, the word "individual" signifies a plurality of personalities corresponding to the multiplicity of relationships in which the individual in question stands. Being an individual by definition means "being-with-others". "With-others", as Macquarrie rightly observes, "...is not added on to a pre-existent and self-sufficient being; rather, both this being (the self) and the others find themselves in a whole wherein they are already related" (1972:104). This is all somewhat boggling for the Cartesian mind, whose conception of individuality now has to move from solitary to solidarity, from independence to interdependence, from individuality *vis-à-vis* community to individuality *à la* community.

In the West, individualism often translates into an impetuous competitiveness. Individual interest rules supreme and society or others are regarded as nothing but a means to individual ends (Khoza, 1994:4, 5, 7; Prinsloo, 1997:2). This is in stark contrast to the African preference for co-operation, in *Obuntubulamu*, to engender agreed upon development models.

Challenges in Obuntubulamu

The *Obuntubulamu* desire for consensus, this inclusivist, collectivist or communalist conception of individuality can easily derail into an oppressive collectivism or communalism, so much adopted by political and academic dictators in Africa. This fact has evoked various responses from African authors. For example: while he lauds the "distinctive African" inclination towards collectivism and a collective sense of responsibility, Teffo (1994:7, 12) is quick to add that the African conception of man does not negate individuality. It merely discourages the view that the individual should take precedence over the community. In the same vein, Khoza (1994:9) and Prinsloo (1995:4) challenges *Obuntubulamu* to create a balance between complete individual autonomy and homonymy, i.e. to broaden respect for the individual and purge collectivism of its negative elements. And Ndaba (1994:14) points out that the collective consciousness evident in the African culture does not mean that the African subject wallows in a formless, shapeless or rudimentary collectivism...[It] simply means that the African subjectivity develops and thrives in a relational setting provided by ongoing contact and interaction with others. I concur. An oppressive communalism constitutes a derailment, an abuse of *Obuntubulamu*. True *Obuntubulamu* incorporates dialogue, i.e. it incorporates both relation and distance. It preserves the other in his otherness, in his uniqueness, without letting him slip into the distance (cf. Macquarrie, 1972:110; Shutte, 1993:49, 51).

A way out of the challenges of Obuntubulamu

Ndaba's emphasis on the "ongoing-ness" of the contact and interaction with others on which the African subjectivity feeds, points to a final important ingredient of the "mutual exposure" prescribed by Ubuntu, viz. respecting the *historicality* of the other. Amid calls for an African Renaissance (Teffo, 1997:19-21), *Obuntubulamu* calls on Africans to be true to themselves. It calls for a liberation of Africans—not so much from the colonizing gaze of others, but from colonization *per se*, i.e. from the practice of colonization, whether of Africans or by Africans.

The flexibility of the other is well noted by *Obuntubulamu*. Or, as is sometimes claimed: "For the [African] humanist, life is without absolutes" (Teffo, 1994:11). An *Obuntubulamu* perception of the other is never fixed or rigidly closed, but adjustable or open-ended. It allows the other, as well a community, to be, to become. It acknowledges the irreducibility of the other, i.e. it never reduces the other to any specific characteristic, conduct or function. This accords with the grammar of the concept *Obuntubulamu*, which denotes both a state of being and one of becoming. As a process of self-realization *through* others, it enhances the self-realization *of* others (Broodryk, 1997: 5-7).

Obuntubulamu underscores the importance of agreement or consensus. African traditions and culture, it seems, have an almost infinite capacity for the pursuit of consensus and reconciliation (Teffo, 1994: 4). African ways do not simply boil down to majority rule or decisions. Traditional African democracy operates in the form of (sometimes extremely lengthy) discussions (Busia, 1967: 28). Although there may be a hierarchy of importance among the speakers, every person gets an equal chance to speak up until some kind of an agreement, consensus or group cohesion is reached.

Although Muwanga-Zake (2007) provides ways of integrating IKS into Western research methodologies, in some instances, the tradition-bound paradigms have to be intellectually revolutionary for new ground-breaking knowledge (Khun, 1962). The revolutions challenge the orderliness imposed by paradigms, especially those that embrace scientific objectivism and verification. Similar to Kuhnian knowledge revolutions, the singular Western conceptual worldview of research, innovations must be within accepted IKS norms, which are likely to restrict adherence and falsifications based on foreign pre-conceptions, data analysis, and explanations. African IKS should determine and own data. In that way, African paradigms will be liberated from foreign novelties, because the worldviews and observations will be fundamentally African.

Possibilities of IKS-Western paradigms

There are possibilities of IKS – Technological innovation hybrids. A hybrid of African IKS as a philosophical fundamental in Africa and the contemporary global development models could be an alternative pathway to salvaging African development. This follows on the observation that valid African discourses and paradigms enhance the research capacity and knowledge to develop communities as well as their IKS (Muwanga-Zake, 2017). The inductive posteriori knowledge approach is perceived to be dynamic, applicable and more desirable in the African societies as it allows organisational managers and their work teams to embrace knowledge construction, dependent on experiences in form of stories and metaphors that demonstrate successful work samples. IKS adds valuable innovations. The tables provide examples of problems that could be solved involving IKS.

Examples of problems that could be solved involving IKS

	Problem to be solved	IKS	Technology	Desirable IKS-Technology Innovation
1.	IKS non-existent in education	IKS – knowledge, philosophy, and processes	Science and Technology	School curriculum <ul style="list-style-type: none"> • Technology in IKS • Language translation/ research
2.	Identification of biological species	Traditional Names and uses.	Inventory of biological species in Africa. AI generated scientific names and uses.	Merging the IKS, AI and uses
3.	Bark Cloth 3.1 Improve cultivation and preservation Mituba (<i>Ficus natalensis</i>) from which the bark cloth (Olubugo) is harvested 3.2 Mechanising bark cloth (Olubugo) processing – minimising use of imported tools 3.3 Commercialisation of Lubugo	How to grow <i>Ficus natalensis</i> in mixed agriculture – systems approach. Kukomaga – processing of the lubugo cloth using a nsaamu. Traditional cloths	Determining the traditional optimum conditions for cultivating <i>Ficus natalensis</i> . Use local tree species to make ensaamu tools and processes. e-commerce	Process of making ensaamu and improving the texture of lubugo.
4.	Easing the extraction of medicines from local herbs	Pound and dry herbs	Scientific extraction of desirable chemicals and plant matter	Collaboration between traditional healers and pharmaceuticals Legalisation of traditional health practices and herbs
5.	Climate/ weather prediction –	Indigenous people able to predict weather- e.g., Shemdoe, Van Damme & Kikula (2009)	Weather tools	IKS use of weather tools to enhance their predictions
6.	Inventory of crop requirements in local environments	Germination requirements and ecological characteristics such as the preferred habitats of particular species – e.g., Tabuti & Van Damme (2012).	Nutrients and other environmental factors required for each crop	Innovate software to determine environmental factors as noted by IKS

Examples of contemporary adoption of African IKS in sustainable development

Examples include investing in green areas to reduce temperatures, improving water quality, and improving agricultural practices to ensure food security

- Traditional fishing grounds, shaped by local and 728 indigenous knowledge, some of which extended outside EEZ boundaries (Page 23).
- Identification and use natural resources in their environment for their wellbeing (Tabuti, 2006).

A problem-solving approach can be used to integrate IK into sustainable development programmes. An example is shown below:

An additional example of integration involves The Centre in Indigenous Knowledge Systems (CIKS) at the University of KwaZulu-Natal (UKZN), South Africa, in collaboration with the Sikh Human Rights Group who use their multi-and transdisciplinary, cultural and community-based nature, to promote the role of traditional medicine, food security, biodiversity, environmental management and curriculum studies and development (with emphasis on non-western paradigms), human rights and justice, for sustainable community livelihood and development, through research, human capital development, knowledge brokerage, networking and community engagement. The Northwest University (NWU) in South Africa offers a Bachelor of Indigenous Knowledge Systems. The degree inter alia includes African indigenous astronomy, African indigenous health systems, African indigenous agriculture, African indigenous science and technology, African indigenous languages, African heritage, African arts and culture, biodiversity, cultural diversity, African indigenous law, African indigenous education, African traditional leadership and governance, etc.

IMPLICATIONS

The UN proposes that the multi, inter, trans- disciplinary nature of IKS for sustainable development, requires that IKS, is supported by teams of intellectually and professionally capable national and international IKS scholars and researchers to enhance its excellence and involvement of community IK-holders and practitioners for community relevance. In terms of the role of HEIs can play in African development, the UN policy proposes the establishment of IKS Centres within the existing structures such as the universities, community centres, etc., which will act as a facilitating and enabling mechanism. Their services, programmes, and projects should involve broad participation and collaboration of members of local and indigenous communities. IKS interdependency and interconnectedness with technological or scientific innovations in Africa would be perceived as an integral part of the knowledge management processes. The proposed IKS-Innovation management model is grounded on the posteriori knowledge approach which assumes that experience is the source of knowledge. The IKS-Technology innovation presumes social interactions and inclusion in educational curricula starting from pre-school to postgraduate learning and research. Therefore, there is a need to derive research themes that explicitly identify problems in Africa that could be researched using African paradigms to enhance sustainability.

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