LEVERAGING INNOVATIVE DIGITAL TECHNOLOGIES FOR INDIGENOUS KNOWLEDGE MANAGEMENT IN POST-COVID-19 ERA: IMPLICATIONS FOR SUSTAINABLE SOCIO-ECONOMIC DEVELOPMENT IN NIGERIA

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Abstract
This article focuses on leveraging innovative digital technologies for indigenous knowledge management in post COVID-19 era, and its implications for sustainable socio-economic development in Nigeria. It used documentary sources and observation as sources of data. It defines digital technologies as electronic tools, systems, devices and resources that generate, store or process data and information. It describes indigenous knowledge as a body of knowledge and skills from indigenous people, developed outside the formal educational system. Such knowledge offers advantages such as being very crucial for sustainable agriculture and food security; efficiency, without depleting the natural resources and the environment. The paper notes that COVID-19 left a devastating impact on the socio-economic development of Nigeria. It identifies innovative digital technologies that can be adopted for indigenous knowledge management as digital video, camera and audio recorders, RADIO Frequency Identification, RFID technologies, 3D scanners, internet connectivity, databases, computers, smart phones, and Geographic Information Systems (GIS). These technologies offer advantages such as indigenous knowledge control, intellectual rights protection, accessibility and reuse of indigenous resources, and prevention of the misuse of indigenous heritage. However, challenges such as fear of loss of intellectual property rights, lack of government support and recognition of indigenous knowledge, inadequate infrastructure, etc, have affected the management of indigenous knowledge with digital technologies. The paper recommends the provision of government policy on indigenous knowledge, incorporation of digital methods of managing indigenous knowledge into modern information disciplines' curriculum and practice, creation of indigenous knowledge management centres across LGAs in the country among other measures to address the challenges identified.

Keywords
Innovative Digital Technologies, Indigenous Knowledge Management, Post-COVID-19 era, Socio-Economic Development, Nigeria

Introduction

The global economy is exponentially drifting away from material resources dependence to a knowledge-driven and digital economy. The Federal Government of Nigeria's decision to create a Ministry tagged Communication and Digital Economy is an attestation to the fact that a developing economy has acknowledged the place and roles of knowledge and digital technologies in socio-economic development and transformation. The knowledge-based economy is one where the delivery of services and production of goods are dependent on the ability to properly manage and effectively utilise the vast amount of information and knowledge at the disposal of man. In the present knowledge-driven society, knowledge is regarded as the most valuable asset in an organisation because knowledge is a contributing factor to individual and the organisational success (Casimir et al.; Sergeeva & Andreeva, as cited in Wah, Zawawi, Yusuf, Sambasivan, & Karim, 2018). Knowledge is so vital to

socio-economic development because socio-political, economic, personal, and career decisions are taken by individuals and groups based on the available knowledge at their disposal (Ayandokun & Nworu, 2021).

Knowledge is a fluid mix of information, experience, skills to provide context or to interpret the new experience and information (Davenport &Prusak, as cited in Satija, 2015). Satija further explains that information and knowledge are mutually dependent. While knowledge is derived from information, without knowledge information cannot be used to make decisions or solve problems. Man's judgment, which essentially applies knowledge, cannot be better than the information on which it is based. Nowadays, organisations no longer compete solely on the basis of financial capital, human resources and strength, rather knowledge is the new competitive advantage in business. In fact the Gross Domestic Product (GDP) growth rate is now determined, amongst other factors, by the quantum and quality of knowledge stock harnessed and applied in the production process in sectors of the economy (Ugwuogu, Ayandokun& Ume, 2018). As the knowledge-based economy grows exponentially, the knowledge assets become invaluable to the organizations. Effective use of knowledge has been crucial to the organization's survival and success in competitive global markets and has a strong potential to problems solving, decision making, organizational performance enhancements and innovation. Knowledge Management defines a systematic, explicit and deliberated building processes required to manage knowledge, the purpose of which is to maximize an enterprise's knowledge-related effectiveness and create values (Bixler, &Stankosky, as cited Huang, n.d).

On the otherhand, there is an evident increase in digital penetration globally, and Nigeria is not left behind. According to the Digital 2021: Nigeria report from DataReportal as stated by Gilbert (2021), as of January 2021, Nigeria had a population of 208.8 million, and about 104.4 million were Internet users, giving a mobile penetration rate of 50%. Of those, 93.3% accessed the Internet via a mobile phone. The number of Internet users in Nigeria increased by 19 million, or 22%, between 2020 and 2021.

With the recognition of the impact of digital technologies on driving a knowledge-based economy, and an evident digital penetration, Nigeria is expected to be able to harness its massive human resources in managing the knowledge at its disposal in delivering a stabilized economy that is grappling under the excruciating pains of dwindling and fluctuating oil prices and COVID-19 induced economic downturn. However, this is not the case as observations show a massive and rapidly increasing inflation. How then can Nigeria tap into her own vast indigenous home-made knowledge to lead herself out of the lingering economic crises? This question is what this paper seeks to answer by identifying how Nigeria can leverage innovative digital technologies for the indigenous knowledge management in post COVID-19 era for sustainable socio-economic development.

Conceptual Definition of Digital Technologies

Digital technologies are electronic tools, systems, devices and resources that generate, store or process data. Well known examples include social media, online games, multimedia and mobile phones (State Government of Victoria, Australia, 2019).Digital technologies and tools are technologies relating to computers or the "Computer Age" (Gökçearslan, Solmaz, &Coşkun, 2017).Digital technologies denote a wide range of technologies, tools, services and applications using various types of hardware and software used to facilitate services or activities by electronic means to create, store, process, transmit and display information. Broadly, digital technologies include the use of personal computers, digital television, radio, mobile phones, robots etc (Tulinayo, Ssentume, &Najjuma, 2018).

Kumi-Yeboah, Sallar, Kiramba, and Kim (2020) define digital technologies as electronic tools, systems, devices, and resources that generate and store data from teaching and learning. It also includes learning materials that use technology across curriculum learning areas with examples such as online games, multimedia, cloud computing, 3D printing, and mobile computing.

Conceptual Definition of Indigenous Knowledge

According to Hunter (2005) indigenous knowledge,also referred to as traditional or local knowledge, refers to the large body of knowledge and skills that has been developed outside the formal educational system. IK is embedded in culture and is unique to a given location or society. It is the basis for decision-making of communities in food, security, human and animal health, education and natural resource management.Indigenous knowledge is defined as the knowledge, beliefs, practices and skills transmitted from one generation to the other through cultural practices expressed in language, dance, songs, folklore and interactions within cultural institutions (Alaribe, 2015). It is the expression of the locally- owned and adapted knowledge of a community – where the community is defined by its location, culture, language, or area of interest (Global Knowledge Partnership, as cited in Akinde, 2008).

Definition of Socio-Economic Development

Development, according to UNESCO (as cited in Mbashir&Alabi, 2013), is summed up as societal growth and change which involves materials, mental, psychological, physical, instructional and organisational innovations. It is the process of change at all level of economic, political, and socio-cultural transformation that results to general improvement in welfare of people living in a defined, or the general society.

Socio-economic development means social development and economic development. It is a combination of all features of the society that makes life meaningful for man as he makes the best of the resources at his disposal. The Bahai International Community (2016) succinctly states that human socio-economic development fundamentally means a growth process which enables people and societies to realize their full potentials. It is a change from a previous state of affairs where members now enjoy an improved standard of living in terms of economic, social, cultural and political well-being such as better jobs, better working conditions, improved housing and shelter, better feeding and meeting the needs of man from time to time.

Chojnicki (2010) emphasises that socio-economic development embraces development changes taking place in the social sphere, mostly of an economic nature. As a result of this, it is further explained that economic change or development cannot be isolated from the social one because this development is meant to be felt by members of the society.

Impact of COVID-19 on Socio-economic Development in Nigeria

Coronavirus was first detected in Wuhan, China and was first reported to the World Health Organisation (WHO) Country Office in China on 31 December 2019. The outbreak was declared a Public Health Emergency of International Concern on 30 January 2020. On March 11, 2020, the World Health Organisation, through its Director-General, TedrosAdhanomGhebreyesus, technically declared Coronavirus, Covid-19 a Pandemic (WHO, 2020). According to the World Health Organisation (2021), as at 5:45 PM Nigerian time, on 21 October, 2021, a total of 242, 348, 657 cases had been confirmed, 4, 927, 723 deaths reported and 6,655,399,359 doses of vaccines had been administered all over the world. Nigeria has had 209, 960 confirmed cumulative cases and

2850 confirmed cumulative deaths as at 5:45PM, same date as above from the time it recorded its first case on the 27th February, 2020.

At a time the Nigerian government based it 2020 budget benchmark on its main source of income, oil, at $57/barrel, oil prices sunk to $29.62/barrel, forcing the government to engage in massive budgetary cuts that would affect education, health and infrastructure. The UNDP (2020) placed this on a 48% decline in revenue. 42% of overall job loss could be traced directly to COVID-19, with a higher percentage of lost employment among the poorest (49%) and urban (48%) households, relative to the wealthiest (39%) and rural households (38%). The commerce, service, and agricultural sectors were hit hardest by the spread of the virus (Oseni, Palacios-Lopez, Mcgee, Amankwah, 2020). Perishable food stuffs were left to rot in the markets while several households managed what they had in stock.

The entertainment and sports industry which employs millions of Nigeria were also affected as football league matches were suspended, spectators barred from entering stadia and sponsors and sport clubs and managements lost revenue that they would have generated from viewership. Eze, Okonkwo, Ezeugwu, Ukwueze, and Ezeugwu (2021) corroborate this as the findings of their study proves that COVID-19 pandemic impacted negatively on the entertainment industry, bringing to a halt the performer/audience physical participation and interaction and a lot of reduction in the socio-economic progress of entertainers and the entertainment industry which depend on their audience for finance. The researchers further explained that the collapse of sporting events due to COVID-19 lockdown affected the grass root people to a great extent. Sports related business, television, advertising, and marketing suffered tremendously.The direct impacts of these unfortunate developments include the increase in criminal activities such as rise of various criminal groups such as the ''One Million Gang'' that created fear in Lagos, such that each neighborhood in the city during the COVID-19 lockdown quickly organized its own security in the absence of the willingness by the police to protect the people (Orji,2020).

Innovative Digital Technologies for Indigenous Knowledge Management and their Importance

All information and knowledge service professions in the society are rapidly taking cognizance of the need to incorporate digital technologies in the delivery of their services. The place of digital technologies has become more cemented in the information and knowledge-drive society more than ever. As such, the following digital technologies have the potentials in revolutionizing the process of indigenous knowledge management.

Mahalik and Mahapatra (2010) noted that after identifying and collecting indigenous information and knowledge, the appropriate technology can be used for capturing that knowledge in variety of media such as, audio, video, digitized and electronic database. All such knowledge available in libraries may be digitized in systematic classification, cataloguing and indexing so that effective retrieval can be made. Whenever required, the retrospective conversion of those documents can be done for developing the digitized format. Similarly, Hunter (2005) observes thatthe first steps in many Indigenous knowledge projects involve identifying the material to be preserved and then capturing it in a digital form so that it can be systematically documented, shared, and re-used by permitted groups or individuals. Determining the optimum and most culturally appropriate approach to selecting, eliciting, recording, describing and disseminating this knowledge without insensitivity, intrusion, constraints, degradation or misrepresentation of the content, is a challenge that is often underestimated.

From the above submissions, it can be deduced that indigenous knowledge management requires identification, selection, capturing, evaluation, documentation of indigenous knowledge, description, conservation and preservation, organisation, retrieval, dissemination, and disposition, when necessary.

The following technologies can be used in the management of indigenous knowledge:

i. **Digital audio recording devices**: One of the problems associated with indigenous knowledge is the absence of documentation. Practitioners `often rely on oral transmission, which could be distorted due to interference and misunderstanding over years. As a result of this, digital audio recorders can be used to record orally transmitted knowledge such as folklore, music, poem, etc. This can form the nucleus of oral traditional archives in libraries, museums, archives, and media houses.

ii. **Digital video and picture cameras**: Digital picture cameras can be used to take pictographic records of events, as long as they do not interfere or contradict the traditional ethics of the indigenous people. The video cameras are very useful when audio-visual records are needed such as in dances, wrestling, sports, drama, coronation, among other events that require to be seen and heard.

iii. **Computers and peripherals**: Computers are very important for indigenous knowledge managers/ centres and the indigenous knowledge users. Computers can be used to store information on artifacts. They are also used in the installation of software packages used to manage indigenous knowledge and manage databases used for same purposes.

iv. **Digital Scanners**: This can be used to make surrogates of indigenous knowledge that has already been documented. Unlike photocopiers, scanners can help preserve the actual colours of the documents. The surrogates prevent theft and mutilation, and could also elongate the life span of information in print.

v. **3D scanners**: There are highly expensive artifacts that have been lost to other communities as we have with Benin Bronze and those from Ile-Ife in Nigeria to colonial masters. Three-dimension scanners can be used to effect virtual repatriation if the actual objects remain subjects of legal and/or administrative disputes. These artifacts in themselves carry detailed cultural and historical knowledge about the ancestors and inhabitants of a particular indigenous people.

vi. **3D printers**: According to Hunter (2006), 3D printers are being used to replicate artifacts for museums allowing the originals to remain with or be returned to their indigenous owners. These knowledge items can be collected into a compilation and accessed through a digital library interface.

vii. **Social media**: Social media are internet-based Web 2.0 applications that can be used to connect with others. Some of them can be used to create and share contents online. In Knowledge management, Abbas (2020) states that they can be used to encourage knowledge sharing, collaborate and facilitate self-directed, informal, and social learning. With the massive presence of Nigerians on social messaging apps like WhatsApp, practitioners of indigenous knowledge and stakeholders could have groups where indigenous knowledge is shared. Indigenous Knowledge Managers and institutions can also use Facebook to partner, reach out to, communicate with and educate indigenous knowledge practitioners.

viii. **Collaborative interactive software**: The software enables the traditional owners to describe, contextualize and annotate resources in their own words, their own languages and from their own perspectives. The importance and value associated with enabling spoken annotations (in addition to textual annotations) is multifaceted: Spoken annotation tools reinforce and support the oral tradition which is so strong in many indigenous cultures, Spoken annotations are an easier and more natural interface for user input than keyboards, particularly for communities with low computer literacy and poor keyboard skills; Spoken annotations represent new language resources which can be used to help preserve threatened languages; Photos and videos can act as a trigger for the Indigenous elders to record their stories, as spoken annotations to the visual resources (Hunter, Koopman, & Sledge, 2002). An example of such software is Tribal Care, a Metadata editor designed by the University of Queensland. It enables indigenous communities to define the ways in which culturally significant or sensitive physical artefacts should be treated - ways which are acceptable to the cultures represented.

ix. **Internet connectivity**: High speed internet connectivity is necessary if Web 2.0 applications will be used for indigenous knowledge management. This is also required if remote access to the databases of museums, archives and libraries housing indigenous knowledge will be made possible. Users should be able to determine if a museum, library or archive has certain indigenous knowledge at their disposal.

x. **Indigenous Knowledge Management software systems:** Just likelibrary management software systems, there are indigenous knowledge management software systems that will facilitate the easy running of the routines of the archive, library or museum. Examples include intranet-based systems e.g *Microsoft Internet Information Server*, Electronic Document Management Systems e.g *ExcaliburRetrievalWare and File Net*, Groupware e.g Microsoft Exchange and Lotus Notes, Knowledge Mapping Systems e.g *Lotus Discovery Server and Trivium Gingo*, Innovation Support Tool e.g *Tech Optimizer*, Competitive Intelligence Tools e.g *VigiPro*. (Carvalho, & Ferrerira, 2001).

xi. **GIS(Geographic Information Systems):** A Geographic Information System provides a framework to document and store indigenous knowledge meaningfully, and employs cartographic and database management techniques such as participatory GIS, map biographies, and historical mapping. (Tripathi, &Bhattarya, 2004).GIS can be a single platform on which, scientific knowledge and indigenous knowledge can be integrated. In the present situation of ongoing unrests between indigenous communities and administrators, across the world, it ensures community participation and will add value to the opinions of indigenous, local communities as a whole in a management, decision-making context (Khan, 2014).

xii. **Radio Frequency Identification RFID technologies for security of indigenous knowledge materials:** This is used for the security of indigenous knowledge in realia, objects and artifacts. The RFID technology is basically combination of microchip and radio signals, the microchip contain the data of individual object and we can identify it through the radio waves. The RFID tags have capability to storing and transmitting information and it replaced both electromagnetic security strips and Barcodes in library application. It is an automatic tracking of the objects or product through radio waves. In RFID is a totally wireless and there is no human interaction between operating and identifying the items. The tags are using for storing the data of objects and it can be retrieve through the radio waves.

The primary objective of RFID is to identify the objects and track them automatically while at the time of operation. RFID plays a vital role in managing library collection and reduces the human efforts in work such as controlling theft, to find misplaced reading material, inventory accuracy, stock verification procedures, security control, etc (Kumbhar, 2017).

xiii. **Mobile Smartphones:** These are the cheapest technologies that can be used to manage indigenous knowledge. They can be used to manage social media sites, send texts to indigenous knowledge stakeholders and interact with indigenous people. They are also multifunctional as they can assist in capturing audio-visual information, and disseminate such information. Smartphones have almost limited digital possibilities.

The use of these technologies offer several advantages such as indigenous knowledge control, protection of intellectual rights, accessibility and reuse of indigenous resources, prevention of the misuse of indigenous heritage, and enabling indigenous communities to describe their resources in their own ways. Hunter, Koopman, and Sledge (2002) state that open source software tools have been designed to enable indigenous communities to protect unique cultural knowledge and materials which have been preserved through digitization. The software tools enable authorized members of communities to: define and control the rights, access and reuse their digital resources; uphold traditional laws pertaining to secret/sacred knowledge or objects; prevent the misuse of indigenous heritage in culturally inappropriate or insensitive ways; ensure proper attribution to the traditional owners; and enable indigenous communities to describe their resources in their own words.When used correctly, with Indigenous groups in control of the production, technology can help to increase cultural activism by enabling indigenous groups to take control of how their culture is portrayed and how their message is spread to national and international forums (Ginsburg, 2008).

Importance of Indigenous Knowledge Management to Sustainable Socio-Economic Development in Nigeria

Knowledge itself occupies a great place in driving socio-economic development. As such, the cheapest and easiest knowledge to acquire must gain its place in terms of proper management. It is only by emphasising the place of indigenous knowledge in societal development that knowledge managers will fully appreciate the need to properly manage it.

Hunter (2005) states that the capture and preservation of indigenous knowledge is being used to revitalise endangered cultures, improve the economic independence and sustainability of Indigenous communities and to increase community-based involvement in planning and development. Benguela Current Commission (as cited in Okello-Obura, 2018) also notes that interest and awareness of the value of indigenous knowledge, particularly its potential contribution to sustainable development, is increasing at a time when such knowledge is being threatened as never before. This local knowledge is very crucial for sustainable agriculture and food security. It is essential in maintaining farm productivity, efficiency and profitability in the long run, without depleting the natural resources and the environment. Therefore, harnessing the Indigenous Agricultural Knowledge potentials is one of the key strategies for developing the agricultural sector (Anyira, Onoriode, &Nwabueze, 2010). Indigenous knowledge systems in emerging economies in general and rural Africa in particular have historically been considered one of the most valuable assets rural people own but also the least mobilized for developing rural communities (Maunganidze, & Halsall, 2016).

Challenges of Adopting Innovative Digital Technologies for Indigenous Knowledge Management in Nigeria

Indigenous knowledge has in the past been suppressed, or at best ignored or neglected by mainstream western science (Britz&Lor as cited in Sarkhel, 2016). The current forces of globalisation, which have strong elements of cultural imperialism and aim at the harmonization of attitudes, supposedly, with the emergence of a global culture and the domination in the use of foreign languages in primary schools in Africa provide little or no room for acquisition of African indigenous knowledge (Eze& Ike, 2013).This position is also similar to that of Srikantaiah (2008), who explains that the impacts of colonization and modernization have undermined and neglected local or indigenous knowledge - not only in current day developing countries but also for select communities in industrialized or developed countries. Indigenous knowledge is marginalized as their scientific paradigms do not align with the Western scientific method. In addition, there are many philosophical and cultural differences between conventional and indigenous knowledge. Therefore, indigenous knowledge often takes a back seat as a "solution" to problems seen in health or agriculture and may only be referred to upon as a final alternative. The erosion of indigenous knowledge, the imperialistic and colonial colour of indigenous knowledge as knowledge that is based on trial and error, and the fact that most of African indigenous knowledge is undocumented, have all contributed in the relegation of indigenous knowledge, making it difficult for Africans to find custom ways of solving some of their societal challenges at the same time, making it difficult for Africans to trace their own origins and use historical antecedents/developments to make informed decisions.

Payyappallimana (2013) identifies the challenges of indigenous knowledge as declining social legitimacy (including government support), lack of recognition of practices and practitioners, lack of self esteem, lack of successors, lack of self determination, rights to resources, intellectual appropriation, multiple worldviews of learners, pedagogical exclusion, hegemonic relationship between knowledge systems, over emphasis on economic growth, prevailing view of traditional Knowledge as antiquated and non dynamic, traditional knowledge is considered exotic and confined to indigenous communities, and lack of sufficient theoretical approaches for understanding and assessing traditional knowledge.

Conclusion

Socio-economic development is societal growth and change which involves materials, mental, psychological, physical, instructional and organisational innovations. It is the process of change at all level of economic, political, and socio-cultural transformation that results to general improvement in welfare of people living in a defined, or the general society. It is often measured by the quality of values humans derive from the material resources at their disposal. The development has now been hinged upon the ability of the society to maximize the potentials of its human and material resources using the knowledge at its disposal. Knowledge itself is not always readily available. It can only be accessed and retrieved for use in order to effect the desired socio-economic development if properly managed. Of all forms of knowledge, indigenous knowledge is the cheapest among indigenous people, but access to, and use of such knowledge have proved difficult due to several challenges such as inability of indigenous people to properly document it for posterity as it heavily relies on oral traditional methods of transfer.

Nigeria is massively rich in culture with hundreds of ethnic groups co-habiting for decades with indigenous practices, some of which have been proven to be effective and transformable in

modern ways. It has also officially recognised that the fourth industrial revolution, which includes the present digital era, can only properly function if run as a knowledge-driven economy. Hence, the reason it created a Ministry of Communication and Digital Economy as a fundamental aspect of its executive arm of government. It is therefore only logical that amidst the challenges associated with using indigenous knowledge to effect socio-economic development and moving Nigeria away from its present state of economic downturn, digital technologies are adopted in order to fully maximize the potentials of its rich and vast volume of underutilized indigenous knowledge among its various sub-national entities.

Having recognised some of the challenges associated with the management of indigenous knowledge using digital technologies, it is important that the following recommended solutions are adopted:

i.   Enactment of a government policy on indigenous knowledge. This will formalise the practice of indigenous knowledge in Nigeria and give indigenous knowledge practitioners a sense of belonging in the corporate entity called Nigeria.

ii.   Incorporation of indigenous knowledge into modern education. Every area of human endeavour, every field of study had its indigenous practice prior to the euro-centric Western methods that have influenced Nigerian socio-economic development. Proven effective indigenous methods can now be incorporated into standards practice in order to encourage local content development and find ways of addressing indigenous challenges in indigenous ways.

iii. There should be a centre for the management of indigenous knowledge each across the 774 Local Government Areas of the nation. This will not just help create a synergy between the government and indigenous knowledge practitioners, but will assist in monitoring and tracing almost extinct indigenous knowledge practices that could help preserve the cultural heritage of the people.

iv.   Creation of a national database for indigenous knowledge either at the national museum or with the national library. This will help in having a 'bibliographic control' of indigenous knowledge systems in the country. Each of the 774 LGAs should be linked to this database so that there will be a seamless flow of data sharing between the local people and the rest of the world. It will also give the indigenous peoples of Nigeria global visibility thereby enhancing the nation's tourism prospects.

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