The Role of Digital Innovations in Information Management in Fostering Sustainable Development in Africa

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Abstract: **Digital innovation in information management is an interdisciplinary program, which thoroughly blends together well-founded knowledge on the establishment and management of various systems of information alongside critical observation of the current digital innovation. Courtesy of fourth industrial revolution, the comprehensive achievement of these innovations will cause a dynamic and formidable boost in enhancing the achievement of the goals of the noble program for sustainable development in Africa. This sustainable development program in Africa is a global organization whose objectives include support to governments, scholarly institutions, local societies and businesses, for the purpose of enhancing and accelerating achievement of goals. The program's initiative constitutes of the seventeen (17) global goals for sustainable development (SDGs), which is a major portion in the broader 2030 Agenda for Sustainable Development that is born out of the Millennium Development Goals (MDGs). I hereby endeavor to elucidate on the role played by the innovated digital information management in fostering each of the SDGs in Africa. The purpose of this paper is to investigate, ascertain, examine, assess, evaluate and establish the role of digitally innovated information management in facilitating the achievement of each of the seventeen global goals for the full satisfaction of their subsequent objectives. The subsequent objective of this paper is to clearly mark and define particular areas of significance in each of the seventeen goals in this program that are facilitated and enhanced by innovated digital information management.**

Key words:

Digital: **business processes that change to fit with the computing world.**

Innovation: **A new idea, creative thoughts, new imaginations in form of device or method that is applied to satisfy a need.**

System: **A set of things working together as parts of a mechanism or an interconnecting network.**

I. INTRODUCTION

The fourth industrial revolution is a technology platform that has introduced a new chapter in human civilization such that it has altered our mode of life, work and interaction among global populace. This platform accounts for the incredible advances in technology unparalleled by its preceding three industrial revolutions. Among the striking characteristics of fourth industrial revolution include, and are not limited to; the homogeneous blending of biological, digital, and physical spheres, with the integrative growth of new technology in the components of various innovations. Digital information is undergoing a dynamic enhancement courtesy of these new technologies, which have heightened its resourcefulness in fostering the attainment of each of the stated sustainable development goals.

Digital Innovations in Information Management

The term digital innovation refers to the deployment of digital technology and digital applications with the objective of enhancing the current business processes and promoting efficiency in workforce, elevating the experience of customers, and introducing new models of business and their products.

Applications of Innovative Technology

Technology is the deployment of components which are utilized in various ways to harness useful products, hence are critical pathways to human development and societal transformation. Each of these components aids information management with numerous innovations that furnish information management to make it valuable in its contribution towards realization of the SDGs.

Sustainable Development Goals (SDGs)

Following are the 2030 SDGs which the UN member states formulated in 2015. They are being held in the highest esteem in their regard as being the subject to UN's universal call to action in working towards achievement of the SDGs.

No Poverty

Poverty is a state of life whose victim survives with less than USD 1.9 per day, accounting for 11% globally, which equals to 0.7 billion people (World Bank, 2017). Causes of poverty include natural disasters, unemployment, conflicts and diseases. Information specialists have innovated Artificial Intelligence (AI), which are sophisticated machines that simulates human intelligence by being programmed to comprehend and exhibit traits that are similar to that of human mind in solving problems (Frankenfield, 2020). With this technology, Plant Village and the International Institute of Tropical Agriculture (IITA) came up with the remedy of diagnosing and detecting symptoms of crop diseases well ahead of time by use of Tensor Flow model that is deployed in the smart phone app (Alcober, 2018).

Zero Hunger

Quality and quantity of food is determined by climatic change which causes disastrous floods, storms, droughts and heat waves. ICTs can afford to undertake close supervision of food security through efficient control of global supplies of food through deployment of mapping techniques that are able to project any likelihood of food shortages. They do this with their Global Positioning Systems (GPS), satellites, machine-to-machine (M2M) connections that boosts infrastructures of remote sensing, PCs, servers, mobile devices, mainframes and network databases. These aid the mapping of food security, analysis, modeling of gleaned data that was obtained through the monitoring efforts, monitoring of environmental/soil conditions and the use of internet in disseminating agricultural information to farmers and other consumers that are helping to promote profitability in farming and sustainability of environment.

Good Health and Well-Being

Diseases and various health problems are alarmingly claiming people's lives, irrespective of the advancement in medical and clinical skills. With such a formidable challenge in handling communicable and highly infectious diseases like the recent covid-19, cloud computing comes in handy with its resourcefully efficient capacity to allow remote access to patient data by health workers from several sources, sharing of the same with the concerned stakeholders, and promptly prescribing protocols of treatment. This restricted patient-doctor contacts restricts further infections and also motivates them to work. Recently some health workers succumbed from infections from their patients, and the rest retreated from work fearing for their health (Dalal, 2020). Cloud platforms blend AI and Machine Learning (ML) in enabling cloud computing to manage massive amounts of data. Digital medical records, mobile apps, big data analytics and patient portals, have lessened bulk of data media for efficiency and effectiveness. Cloud computing allows for economic allowance to alter the data storage capacity based on the stream of patients, hence safeguarding data storage and avoid extra costs of maintaining physical servers.

Apart from allowing users to remotely access information, cloud computing also enable backup automation and anticipate options for disaster recovery, ultimately ensuring the security of data and minimize staff downtime in the eventuality of a breach (Douglas, 2019). Besides, cloud computing protect healthcare equipments from unauthorized access and any malicious breaches.

Quality Education

Quality education is the basis for the prosperity of our society because it empowers people economically, intellectually and professionally to transform the available potential resources so as to enhance their livelihood. Quality education promotes peace and tolerance, which are essential prerequisites for greater development.

Internet of Things (IoT), is a network of internet connected objects (termed as 'things') which (things) are able to sense, collect, exchange and send data to one another and also to the internet. The data in the IoT can also be accessible by other 'things' thereby intensify the network connectivity within and without.

The set-up of most high schools and universities is ideal for IoT utilization, due to the shifting of students from paperwork learning materials to the digital counterparts of the same as facilitated by personal computers. The current digital enhancements has been achieved by widespread coverage of cheap internet. The individual supervision of each student by professors, as well as tracking the progress of each of them, is make possible the utility of cloud-connected devices. This implies that this technology will make teachers afford to use the same time to perfect their personalized instructions courtesy of IoT's capabilities in automating previously conducted processes. Practically, students' presence in classrooms could be sensitively detected, disregarding the need for marking attendance registers, hence saving a great deal of time.

Special consideration can be accorded to students who have problems with their vision, through provision of special cards which could be automatically detected. These cards automatically inform other responsible devices to adjust text fonts accordingly to befit the students' need specifications. With such advancement, IoT can be able to equalize the essential access to education by each and every student. "The IoT technology allows teachers to design their lesson plans in a way that combines more than one teaching method (Mehta, 2017). Incorporating a variety of technological enhancements enables a teacher to program each of them and then put learning into the hands of the students." This implies that self-learning of each student, with consideration of each one's special need, will be made possible, thereby promoting confidence as well as enriching the process of learning. Looking to the educational sphere outside classroom environment, the same IoT connections are well capable of connecting classroom details to remote professionals and leaders, thereby facilitating a resourceful interdisciplinary approach to learning as demanded by today's world for relevant education (Mehta, 2017).

Gender Equality

Equality in gender prescribes for the same treatment among men and women without discrimination. There is an alarming gender discrimination against women and girls on the basis of allocation of such facilities like education, work force, health and political representation. There is remorseless underrepresentation of women in managerial and leadership positions in both private and public sectors whereby according to the investigation of United Nations, women in the management positions are only represented by less than a third (Sustainable Development Goals, 2019). However, ICT has brought up unusual opportunities for women as an

affirmative action geared towards bringing them up to be at per with their male counterparts in the sharing of knowledge, commerce activities and networking (Women 2000 and Beyond, 2005). App Academy is a software school that creates programs which make inclusive coding in their scholarship loan applications, conditioning only the hired students to pay back the loan, thereby promoting employment for all (Williams, 2019). Phone2Action and other digital advocacy platforms are software that enable people to link up with policymakers by use of their mobile phones through email, Facebook and Twitter, hence an inclusiveness that have women to be well represented (Williams, 2019).

Clean Water and Sanitation

Globally, clean water and descent sanitation suffers alarming limitations, and even this little bit of them fall below the expected standards of hygiene, exposing the entire humanity to health hazards. Lacks of these essential necessities greatly hamper community's socio-economic development as well as driving the same community into a catastrophic health disaster.

Geographical information system (GIS) is a system engineered to search, capture, analyze, manipulate, store, manage, present and disseminate vast geographical data for facilitating decision making. GIS displays its magnanimous potential to amass vast amounts of relevant information required to balance various competing priorities and tackling incidental challenges such as optimizing locations of water sources and determining the feasibility of sites for waste disposal. Being a custodian of Environmental Impact Analysis (EIA), GIS is a pioneer policy initiative for conserving natural resources and environment. Here it monitors human activities, most critical of them being radioactive waste disposal. Essential assessment of natural features like water catchment areas can be performed by integrating various GIS layers. GIS technology helps the water and forestry resources to be well managed and maintained, as well as analyzing equitable distribution of water resources. Through wetland mapping, GIS administer water retention during dry periods, thus keeping water table high and stable. Using data from remote sensing, GIS endeavors wetland mapping and undertakes designing of projects for water conservation. ICTs' have come up with sophisticated intelligent systems known as smart grids, which blend together the distribution of water generation and transmission, demand management, and distribution grid management (Villa & Mitchell, 2010). Such set-up facilitates sensor-enabled real-time notification to utility companies, making prompt responses possible regarding changes in water costs, demand, supply, and sanitary emissions,

Affordable and Clean Energy

Affordable and reliable energy is very indispensable to the growing global population. The number of those who cannot access electricity has doubled in the period of time between 2000 and 2016, due to a condition that forces them to adopt harmful cooking alternatives that jeopardizes their health by their exposure to emissions that pollutes air (United Nations, 2015). ICT offers innovated friendly smart solution out of this unhealthy state by trimming down use of energy and resources through selling and exchanging ideas/information instead of goods and raw materials. Invention of intelligent designs of production as depicted in the "sleep mode" of shortly unused computers cuts down energy consumption. Management of global greenhouse gas emissions is enhanced by decarburization of energy provision, which is also aided by innovated technologies like machine learning, IoT, and big data. Cyber-physical systems (CPS) are used to digitize energy systems leading to low-carbon energy system, hence combination of CPS and AI for progressing decarbonization (Inderwildi et al., 2020). It's important for students take the role of world intelligence producers and participate to revitalize decision-making. Innovations in digital information management give the effective mode of this transfer of knowledge for fostering transformation in the society (Wolf et al., 2016). Many of these improvements are possible because of the use of ICT to manage and transmit the information.

Decent Work and Economic Growth

There is a great inequality and a slowing down of growth rate of our economy, which is heightening unemployment and poverty scales. There is a dire need for decent work and economic growth without which there will be continuous lack of legitimate job opportunities and undermining of global progress. Big data, an innovated component of in the digital information management, has the capacity to help in assessing the socio-economic status of populations which will enable governments to provide targeted initiatives for the provision of jobs (Blumenstock et al. 2015). It is an enormous volume of both structured and unstructured data which can't be processed by means of traditional software techniques and database.

Industry, Innovation and Infrastructure

With the current rate of population growth, it is becoming very crucial to sustain development in industry so as to meet the peripheral socio-economic demands in sustaining our societies. On the other hand, there is dire need for innovation and resilience infrastructure to address challenges incidental to exponential industrialization, such as inadequate access to basic infrastructure which is required to match the prevalent industrialization so as to strike the balance with social and environmental amenities. The application of Industry 5.0, a digital innovation that interacts activities of humans and machines, where robots are deployed for better, faster and higher value work operations. Robots take up monotonous tasks that are debasing and risky to human beings, such as welding, painting, loading and unloading heavy and dangerous materials, working overtime, etc. (Maida, 2019).

Reduced Inequalities

Differences on individual income, sex, sexual orientation, age, class, ethnicity, disability, race, residence or religion possess a debasing scenario in global development. One of the practical realities of these incidences is payment/salary/wages, an inequality that undermines self-esteem and is also detrimental to sustainable economic and social development. This inequality vice is effectively resolved by Blockchain technology, which involves systematic applications of distributed database that are used to store and manage records in organizations records (Ernst & Young Global Limited, 2017). According to Sylvester (2019) blockchain consists of linked chain that stores auditable data in units called blocks. The chain of blocks makes a record of transactions or public accounting book or ledger that is shared by all the computer terminals or nodes in the network (Dwyer, 2014). In simplest terms, blockchain is the distributed database system that records and shares data and information transactions in the network. It obligates each network participant to reach an agreement known as consensus. All the data stored on a blockchain is recorded digitally and availed to each network participant. Its provision of technological mechanism for equitable and authentic sharing of economy eliminates the slightest chances of any inequality without the need of a third-party. When an economic entity in a community is owned by every member of that community and revenue is made in that entity, it is equally distributed to each individual member in that community, hence ensuring equitable distribution of economy (Bergguen, 2018).

Sustainable Cities and Communities

Cities are the hub of commerce and yet they face job creation and infrastructure challenges such as housing shortages, overcrowding underfunded public services and pollution in their bid to curb exceeding urbanization and crisis of global refugee. Deployment of ICT provides solution in the urbanization crises spanning from sophisticated retrofitting and many more innovative designs to urban management and planning (United Nations, 2013). Geospatial implements including geographical information system data layers, and satellite maps can be used for various purposes of mappings, identifications, provision of virtual addresses, and combining multilayer statistical information with satellite maps to run analyses of poverty targeting, urban infrastructure, transport planning, crime statistics and tracking illegal settlements (UNCTAD, 2012). Simulation, modeling and visualization technologies can be used by city planners to support investment decisions and long-term planning. Tools of simulation are adopted for conducting plans for urban development, building designs, energy analysis, traffic and calculations of emissions. ICTs can be applied for the improvement of mobility in urban centers, including management of traffic, planning multimodal trip and pricing for congestion. Smart mobile phones and ICTs avails to city dwellers the benefits of new models of business mobility car sharing, car pooling and incentive programs that credit cycling to work.

Responsible Consumption and Production

A painful imagination of the rate of disappearance of the world's treasure of forests, minerals, and many other consumable assets has demanded for stern regulation of their exploitation. There seems to be an overriding false sensation of the cheapness of these resources for the good of future generations, causing them to be exorbitantly exploited so fast, and that in consequence of their excessive cheapness they are being produced and consumed wastefully (Solow, 2008).

The existing natural resources are alarmingly misused and wasted through patterns of production and consumption. Evidence of this is the amount of agricultural produce that is wasted or lost in the processes of harvesting, transportation, retail and storage; and pollution rate of fresh water being higher than the rate of purifying it. Such wasteful habits damage our earth's catchment for these resources as well as putting the same earth in a more deficient position to provide for the growing population. ICTs can facilitate the adoption of Digital Twins by which the whole life cycle of physical objects is virtually represented, in enhancing responsible consumption and production. Environmental In-formation Systems (EIS) collect, gather, sort and analyze data and information related to environment. Spatial data processing deploys GIS technology to utilize voluminous geodata in responding to business questions, identifying risks and solving of critical problems.

Climate Action

The alarming temperature increase on the planet earth comes with costly environmental predicaments, the major one of which is the increment of sea level caused by liquidation of polar ice caps (United Nations, 2018). According to the current scientific evidence, global warming is majorly caused by entrapment of heat by the atmosphere occasioned by greenhouse layer of gas molecules that builds up to act like thermal blanket around the earth, a phenomenon known as greenhouse effect which is occasioned by water vapor, carbon dioxide, methane and nitrous oxide (Kaddo, 2016). Increase of these gases is brought about by man's irresponsible activities such as deforestation and combustion of fossil fuels. Artificial Intelligence (AI) enables the automation of consumer purchases with algorithms that carry potential capacity to influence consumer behavior related to greenhouse gases (GHGs) emissions. ICTs can use technologies of renewable energy to integrate automated data capture, sensors, measurement of performance or other mechanisms so as to enable the creation of electricity, heat and fuel from renewable sources. ICTs can also facilitate the adoption of digital twins to combat climate change, which is an appealing proposal for those areas that are affected by high population growth rate, size and energy consumption. 5G technology can increase speeds and coverage of devices and elongate the life of their batteries, capability of data transfer, and increase

reliability and efficiency that results in less wastage and less poisonous usage of fossil energy and power. ICTs incorporates weather satellites which monitors development of typhoons and hurricanes; weather radars which monitors development of thunderstorms, tornadoes, volcanic effluents and forest fires; meteorological aid radio-based systems which gathers and analyses weather data; and earth observation satellite systems that obtain environmental information such as atmospheric composition (e.g. CO2, vapor, ozone concentration) and ocean parameters (temperature, surface-level change).

Life below Water

Some of the numerous economic and developmental benefits of oceans are storage of carbon dioxide; regulation of climatic and weather patterns; source of food, oxygen, transportation, medicine, recreation, and employment through ocean-based businesses; hence their need for sustenance through conservation (NOAA, 2018). Oceans are endangered by water warming and acidification caused by global climatic change, overfishing, plastic pollution and unprotected marine areas. Machine learning, satellite observation, and open data allow for the processing of production of massive amounts of data to manage the enormous task of tracking and measuring life under the vast earth's water masses.

Global Fishing Watch (GFW) deploys satellite monitoring in their real-time tracking of fishing vessels so as to bring global fishing under control. Machine learning safeguards and manages life under water by inventing an automatic detector that identifies any endangered species in oceanic bodies so as to save researchers' tedious initiative of sifting through numerous aerial photos to spot the needed species (Mills, 2017). It enables this to be simply done by feeding the pictures of earmarked species with the use of image recognition system that can identify the species' body shapes. Similarly, the XL Catlin Seaview Surveyor is another invention with a high-resolution in its 360-degree panoramic vision recordings, that performs revelation and monitoring of changes of submarine features (like depletion of coral reefs) over time. Marine Skin tag is a lightweight tag that is glued to the outer shell of sea animals, which gathers and analyzes data geared towards preserving and enhancing marine life.

Life on Land

People and animals across the globe are adversely affected by desertification, deforestation and biodiversity threats, which also cause loss of habitat with poaching and wildlife trafficking that jeopardize numerous species pending extinction (Chappell & Rott, 2019). Artificial Intelligence, ICTs, 5G, weather satellites, Google, Marine Skin tag and XL Catlin Seaview Surveyors, digital twins, 3Rs and Environmental In-formation Systems (EIS), used in the marine, climate action and responsible consumption and production are similarly applicable here. Artificial intelligence has been increasingly used to support the study of coupled land systems, which are complex adaptive spatial systems driven by land use and land cover change. Recent developments in deep learning together with big data represent unique opportunities for using artificial intelligence to further advance spatiotemporally explicit land change modeling.

Cyborg animals are the use of microchips that are linked to the brains of animals, and having them remotely controlled. These together with Robots can be adopted for accessing such areas that are otherwise inaccessible, as well as for limiting unwanted contacts between protected species and humans. The use of camera-trapping which detects the motion of a passing animal will enable detection of human presence and vulnerable species in inaccessible areas. Bioacoustics, which is the study of sound utility and acoustical perception among humans and other animals, can facilitate detection of human encroachment on protected areas. Status of wild reproduction and other physiological parameters can be monitored by biotelemetry devices and mobile communication networks. Advances in brain mapping may eventually be applied to technologies that can determine how species perceive their environment. This information will help to identify and eliminate stress impeding reproduction or survival, thereby improving animal welfare.

Peace, Justice and Strong Institutions

There is dire need for peace, justice, accountable and inclusive institutions. Great initiatives need to be endeavored in curbing violence (particularly against children), taming bribery and corruption, promoting institutions' transparency and clearing access to justice. U-Report, a mobile empowerment program, links up young people globally to their decision makers and governments, exchanging resourceful information, and enhancing accountability of children's programs. Human RFID (Radio Frequency IDentification) microchips embedded under the skin provide a digital interface to the real world centered about the holder's identity of all information concerning him/her which is stored under his/her skin. With this technology each person is fully identified and monitored by the central system, making it impossible for one to get lost or commit any crime unnoticed, etc, hence heightening safety and security. Detailed information about what each person does is easily retrieved by rewinding and inspecting GPS (Global Positioning System) intersections. With an implant firearm system, there will be law enforcement and firearm control requiring weapons to be within close proximity of their owner in order to fire (Brown, 2016). In case guns get stolen, no one else apart from the registered owners will be able to fire them. This subsequently implies that no weapons will be lost because GPS readings in their chips will relay a full report of their location and their possessors at the moment of firing.

Partnership for the Goals

Ultimately, partnership calls for stakeholders' important collaborations in forging for the achievement of SDGs

through their contributions towards various monetary and technological resources.

Information management has come up with Deep Learning Indaba, whose mission is to strengthen the innovation of African Machine Learning (ML) and whose aim is to foster membership in African Intelligence (AI) community through teaching, research, exchange, and debate the ML and AI state of the art (Technology Partnerships for the Global Goals, n.d.). ML is an application of AI which enables systems to be able to automatically learn and improve from experience without being programmed explicitly. Courtesy of Deep Learning Indaba, researchers, students and developers meet yearly to share knowledge on ML advances as a community, resulting into an establishment of distributed model of leadership and growth development as well as positive community building within African machine learning community.

U-Report aids SDGs partnership, which is a program created by UNICEF that is empowered by mobile phones communication platforms for connecting all young people to their governments and decision makers, sharing information on lifesaving and life changing, and enhancing accountability of programs for children (Technology Partnerships for the Global Goals, n.d.). Data Science Africa is a non-profit knowledge sharing professional group that aims to bring together leading researchers and practitioners who work on data science and machine learning methods and applications relevant to Africa, and providing training on state of the art data science methods to students and others interested in developing practical skills (Technology Partnerships for the Global Goals, n.d.).

II. CONCLUSION

Ideal digital information management has an immense cross-cutting contribution in the process of attaining each SDG. The rapid advancement of ICT and knowledge intensity of economic activities is creating noble opportunities to penetrate barriers to development, enhancing "leapfrogging" of technology and boosting the efficacy of ICT in development. Incidental innovations to the various attributes of digital information management will further eradicate gaps in provision, access, and diffusion of knowledge; hence opening up the grounds for best practices in the initiation of SDGs.

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