


Digital Transformation in Communities of Africa

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ABSTRACT

This paper synthesises, categorises, and provides clarity on the African continent's digital transformation (DT) programs that align with the United Nations development initiatives and Africa's Agenda 2063 and its subprograms. It provides that analysis is needed to understand the digital landscape across the continent for those interested in FDI opportunities and other social enterprises looking to impact all aspects of African socioeconomic digital development. The author believes this paper is relevant for understanding the challenges and opportunities of the current and future areas of the African digital ecosystem.

KEYWORDS

African Socioeconomic, Information and Communications Technology, Digital Development, Digital Technologies Entrepreneurship, Information Technology

INTRODUCTION

A new generation of youthful 'digital natives' is growing across Africa and set to fuel growth and drive adoption of new digital technologies services geared to impact all areas of African society, empowering lives, transforming businesses, and increasing engagement, equitability, and wellbeing — impacting all the continent's cities, towns, and villages. The challenge of degree of heterogeneity and differences in growth models across these emerging economies is significant for growth as countries are not starting from the same base. To revive economic growth and job creation in Africa, international research institutions such as the World Bank (WB), United Nations (UN), International Monetary Fund (IMF), Organisation for Economic Co-operation and Development (OECD), World Economic Forum (WEF), and European Commission (EC) have focused their attention on the growth of digitisation in industry and enterprises (African Development Bank [AfDB] et al., 2017; Arntz, Gregory, & Zierahn, 2016; European Economic and Social Committee, 2017; OECD, 2017; WEF, 2016). Such institutions define digitisation as the mass adoption of connected digital services by consumers, enterprises, and governments (AfDB et al., 2017; OECD, 2017; WEF, 2016).

Empirical work undertaken across the African Union (AU) highlights vision priority areas as covering economic growth, sustainable development, employment, and wellbeing for people and communities, with initiatives being developed for the broader and long-term AU Agenda 2063, forming the first of the 10-year incremental phasing strategies using technologies to impact critical sectors of, among others, agriculture, energy, environment, health, infrastructure development, mining, security, and water (OECD, 2017; WEF, 2016; WB, 2019a).

This empirical investigation combining the role that selected digital technologies play in overcoming social and economic challenges is presented and discussed. The aim is to contribute

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towards advancing relevant knowledge and recommendations for the future on the theoretical direction of digital transformation (DT) in African economies and communities. The study's objectives were to explore policies and programs aimed at enabling African countries and communities to adopt ways to improve socioeconomic development performance and communities' prosperity by enhancing digital technologies. The question asked is whether African countries can take advantage of programs such as those implemented in other emerging economies of East Asia like India, Korea, and Singapore. The primary objective was to assess the ability of current frameworks, such as those proposed by the G7 and G20, to deliver the potential of DT to increase trade and economic growth, bridge inequalities in African countries, and further enhance rural communities' growth (Department of International Relations and Cooperation, 2019; WB, 2019c). Specifically, objectives centered on:

1. reviewing demographic and economic opportunities and challenges and assessing their implications for attainment of the continent's digital development aspirations (Tor, 2017);
2. using digital development methodology, frameworks, and roadmaps to benchmark achievement; and
3. examining African ICT liberalization and the role of facilitating governments.

METHODOLOGY AND DATA COMPILATION

The study reviewed 1468 documents over six months — primary literature, secondary analysis of data, identification of policies, briefings, and notes, and a comparison of emerging market country frameworks on DT implementation. The study used international policy documents, briefings, working papers, frameworks, and roadmaps of actions used by the AU, United Nations Economic Commission for Africa (UNECA) agencies, WB, OECD, WEF, Institute for Security Studies (ISS), World Summit on the Information Society (WSIS), and International Telecommunication Union (ITU) obtainable across search engines, specialist database, Government and non-governmental agencies across African countries, EU, USA.

Specific documents used were those aligned with Digital Africa's broader goals 2030-63 and initiatives to achieve these digital strategies and programmes for transformation as shown in *Annex A1*, *Annex A2*.

The purpose was to review those primary documents on digital technology developments for short-to-long-term aspirations, applications, and contributions within and across sectors. These reviews helped to identify key digital development challenges and opportunities, explore potential solutions, and assess how the frameworks align with countries' ability to attain digital development aspirations. The frameworks, roadmaps, and guidance documents put into practice the following scenario: OECD's Going Digital projects, with integration policy frameworks across seven building blocks (access, use, innovation, trust, jobs, society and market openness) and supported by quantitative indicators and practical policy guidance. The synthesized data bring together the policies African governments must consider in order first shape and achieve a common African digital.

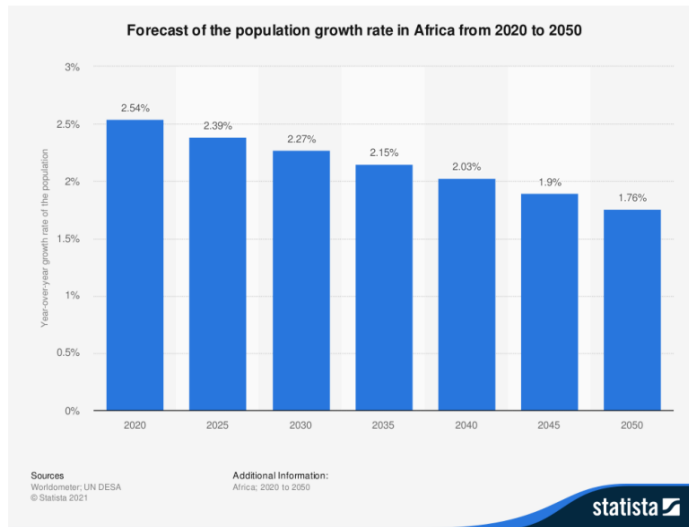
MAIN ECONOMIC CHALLENGES FACING AFRICA

Africa's population is the fastest growing in the world *Bar Chart 1. Population growth rate in Africa 2020-2050*. It is expected to increase by approximately 50% over the next 18 years, from 1.2 billion people to over 2.15 billion by 2035-2050 (AfDB, 2014,). A forecasted 0.10% declining trend from benchmark year 2020.

From a socioeconomic perspective, population growth constituting working-age individuals (aged 15 to 24) is crucial in regional development (fig1) and has potential for the continent's overall economic wellbeing.

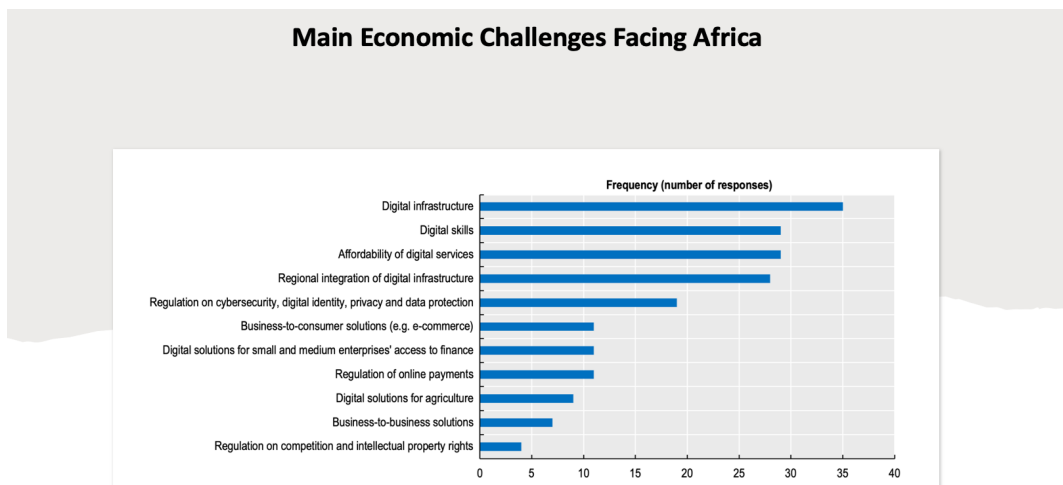
Figure 1. Population growth rate in Africa 2020-2050

Main Economic Challenges Facing Africa



Notes: Figure.2 shows answers to the survey question, “Which of the following areas of digitalisation do you think should be the priorities for regional and continental co-operation to help

Figure 2. Data source: United Nations(2013)World Population Prospects.



create more and better jobs in your region?”. It is based on responses from six (out of Africa’s eight) Regional Economic Communities and on individual assessment on 23 African countries. Respondent to the survey included policy makers, experts on digitalisation and representatives of private companies working in Africa’s telecom and digital activities. For this question, each respondent was asked to select five top priority areas out of an open-ended list of 15 areas, with an option to add any additional areas of their choice.

AU governments are working with technology partner organizations across the region to solve challenges not in employment, education or training (NEET), including health a contributor to easing financial burdens for young working adults (aged 15 to 29), and prioritizing eight pillars to diminish social risks and lack of employment opportunities and increase technology skills and public expenditure.

The related action areas, discussed in dedicated sections below, are: employment and entrepreneurship; education and skills development; gender, health, and wellbeing (excluding family planning); rights, governance, and youth empowerment; agriculture, climate change, and the environment; and telecommunication and infrastructure these form the broader discussion areas of Main Economic Challenges Facing Africa.

Governments faced with socioeconomic challenges, widespread unemployment, and political marginalization see the need to invest in the working-age group for job creation (AUC, 2017; AUC/OECD, 2020; Arnould & Strazzari, 2017). The WEF and the International Trade Centre (ITC), a community of business leaders and experts, have identified areas for consideration, ranging from refreshing policies and expanding connectivity to upgrading logistics and managing data. Each area comes with a goal and recommended steps (ITC and WEF, 2019).

E-Employment and E-Entrepreneurship

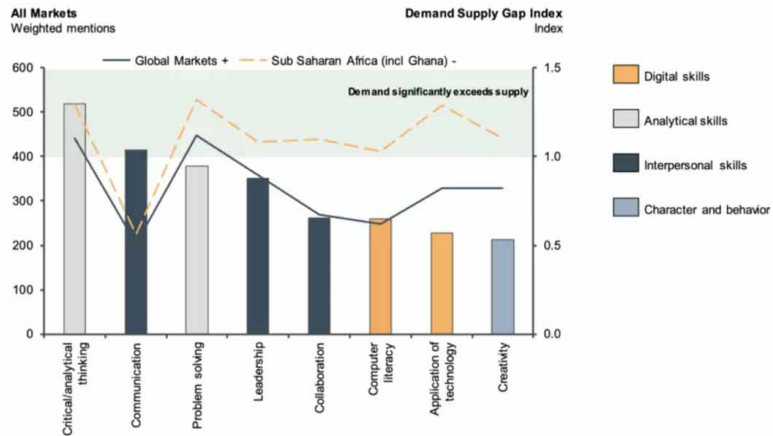
The Employment Landscape

The African labor force is projected to expand by more than 14 million per year. Economic growth rates post-pandemic are forecast to fall sharply from 2.4% in 2019 to -2.1 to -5.1% in 2020, marking the first recession in the region over the last 25 years (WB, 2020a). Recent epidemics have also slowed youth employment and education, lowering the potential to create enough quality jobs against the tide of this fast-growing labor force.

E-Employment - Cases on digital initiatives for access (Internet, e-mail) to increase employability and alleviate unemployment through e-networking with recruitment agencies government agencies, and businesses, thus enabling job creation, include Mauritius’ e-Recruitment System allowing citizens to apply for a post not only from a personal computer but also through their smartphones (Gürtzgen, Nolte & Pohlen et.al, 2018). The development of this portal serves in advancing progress in SDGs 8, 9, and 17. In Nigeria, the Nigerian Postal Service initiated the project NIPOST Address Verification System, establishing a platform that can create hundreds of thousands of sustainable jobs. Any qualified individual with a smartphone, Internet access, and NIPOST Address Verification System agent app can join the community and get a paying job (SDGs 1, 2, 5, 8, 10, 11, and 16). In South Africa, the Department of Public Service and Administration has officially launched the government’s e-recruitment system enabling job seekers to apply for positions in public service through an online platform (SDGs 8, 9, and 17). In Rwanda, Job in Rwanda Ltd. developed an online recruitment portal connecting skills and facilitating recruitment operations between employers and candidates (SDGs 8, 9, and 17). DIGIFY AFRICA, for employment-oriented skills training in Ghana, provides digital skills training to youth and entrepreneurs looking to enter the marketing industry or grow their businesses through online and in-person courses. It boasts a strong alumni network of over 75,000 individuals as well as more than 40 agency partners to produce digital campaigns, content, and services. It has seen over 500 new professional careers since its inception in 2014 (International Finance Corporation [IFC], 2019).

Figure 3. Supply and Demand for Most Important Workforce Skills

E-Employment and E-Entrepreneurship



The Entrepreneurial Landscape

Twenty-two percent of Africa's working-age population are starting businesses concentrated within a limited number of sectors. Activities include retail (64%) and the hotel and restaurant trade (97%). The retail sector has low-growth businesses, with 54% employing only the business owner (Guislain, 2018; Herrington & Kew, 2016). Africa's female entrepreneurship rate is the highest in the world; 27% of the female adult population is engaged in early-stage entrepreneurial activity. Small and medium enterprises are now the biggest formal employers in sub-Saharan Africa (SSA) and key in creating 54 million jobs across the continent by 2022. An additional consideration is that Africa has the highest small business discontinuance rate (Herrington & Kew, 2016, 2017).

Digital technologies are transforming traditional jobs and creating new forms of work (International Labour Organization, 2018). Large companies are increasingly contracting smaller firms in other countries to perform entire business processes and functions. A growing number of workers are also engaging in microwork, working online to complete a series of small, less skill-intensive tasks through platforms such as Amazon Mechanical Turk and Figure Eight (WB, 2015).

E-Entrepreneurship - The United Nations Conference on Trade and Development (UNCTAD) demonstrated the business-to-consumer e-commerce market in Africa as worth about \$5.7 billion in 2017, representing less than 0.5% of the continent's GDP — far below the world average of over 4%. Increasing e-business platform initiatives have been developed and range from those with focus markets, like Angola's Barb Look web platform for barbershops and clients to choose which service they want, to a Burundi-based East African Community e-marketplace that is an east African online distribution center for connecting small businesses and rural communities to local, regional, and international markets online (SDGs 1, 3, 5, 8, 9, 10, 12, and 17). Another country case is Cote d'Ivoire's TaxiJet, the first Ivoirian taxi booking platform. In Tunisia, two major government initiatives encourage Tunisian companies to use ICTs to increase their productivity and created specialized research centers

and technology parks to strengthen the existing synergy between educational institutions and the private sector. In Nigeria, the Postal Service launched the NIPOST Electronic Stamp, developing a one-of-a-kind electronic stamp called QuBit that can meet the current day's needs and denote business challenges. With its new electronic stamp, over 61 million Nigerians will be engaged, some 113,000 jobs created directly and indirectly, and a user-friendly experience established with NIPOST. This project assists in advancing SDGs 1, 2, 8, 9, and 17. Also in Rwanda, Tap & Go (a product of AC Group Ltd), is being used in Kigali and Yaoundé, with over 670,000 users daily. The project is carried out in partnership with the WEF, Government of Rwanda, Kigali Bus Services, Rwanda Federation of Transport Cooperatives, Royal Express, Government of Cameroon, STECY, DMM.com, and Transform Africa, and it relates to SDGs 8, 9, 11, and 17. Additionally, in an effort to reduce corruption, improve transparency and efficiency, and minimize potential collusion among bidders, Rwanda has established electronic government procurement systems known as *Umucyo*, meaning "transparency" in the local language. *Umucyo*, a web-based e-procurement system, was developed as part of a WB-funded public-sector reform program for better government-to-business results. The system is open to all, meeting SDGs 1, 8, 9, and 16. In Uganda, Bizcusc is a mobile web-based application system for expanding the customer, market, and transport accessibility base for businessmen and farmers. Bizcusc runs on all mobile devices and computers. The problem it targets resides in the fact that farmers lack information on updated commodity prices offered by different agro-businessmen. This project is therefore extremely useful as it relates to poverty, food security, and gender equality issues (SDGs 1, 2, and 5). Kenya M-PESA makes domestic payments easy. Started in 2007, it now boasts 30 million users in 10 countries, with other competitors such as MTN Money, Orange Money, and Airtel money also operating around the continent. M-PESA services are now offered in countries as diverse as Albania, D.R. Congo, Egypt, Ghana, India, Kenya, Lesotho, Mozambique, Romania, and Tanzania. This initiative assists in advancing all 17 SDGs (GSMA, 2019; UNECA, 2019). Similarly, financial technology ("fintech") has also expanded across Africa over the past years: 21% of adults in Africa now have a mobile money account, with numbers having doubled since 2014, the highest of any region globally (Demirgüç-Kunt et al., 2018). Digital technology can also spearhead employment, as a recent WB report on the future of work in Africa points out (Choi et al., 2019). Jobs directly attributed to the mobile economy lay at 1.1 million and were projected to reach 1.3 million in 2020, with an additional 2 million indirect jobs (GSMA, 2017).

E-Education and E-Skills

The Digital Education and Skills Landscape

Structural problems affecting education systems continue to be a stumbling block in the African group of countries' efforts to stimulate sustainable entrepreneurial activity and improve business productivity. The Continental Education Strategy for Africa (CESA) (AU, 2015) aims to transform education systems commensurate with the wider vision of increased ICTs and digital skills for economic growth and business. CESA has moved to incorporate ICTs, digital tools, and massive open online courses (MOOCs) as possible solutions (AU, 2015). This section provides a clear relationship between the level of education and the likelihood of business owners' success indicating growth expectations within a business. The disparity in education indicates that 65% of low-growth business operators only have a primary school education while 80% of high-growth businesses have completed secondary, post-secondary, or tertiary education. To alleviate shortfalls in education infrastructure, investments, standards, and skill development, the AU envisioned a 10-year continental education strategy 2063 Agenda roadmap to realize the knowledge, competences, skills, innovation, and creativity for core African values and promote sustainable development at national, sub-regional, and continent levels to "create a new African citizen" who will be an effective change agent (AU, 2015; Global Education Monitoring Report Team, 2017).

As partner initiatives, HP's Learning Initiative for Entrepreneurs (HP LIFE) and the Be Online program offer two unique online digital learning platforms presented to support education,

employment, engagement, and entrepreneurship. The aims are to enable better learning outcomes for 100 million people by 2025 and add 1 million users between 2016 and 2025 — a commitment that aligns with the AU's CESA. The CESA 16-25 guiding principles, pillars, and objectives are geared to fulfil Aspiration 6 of the Agenda 2016 vision to build on education policy to provide vocational training and science, technology, and innovation actions underpinned by communication and governance to give stakeholders and actors the freedom to act and realize initiatives (Mundy et al., 2017; Tikly, 2019).

Additional actions include the Science, Technology and Innovation Strategy for Africa (STISA – 2024) initiatives, which use learning technologies to impact education technology and e-learning opportunities, and the Continental Strategy for Technical, Vocational Education and Education (TVET), to support economic development and the creation of national wealth and contribute to poverty reduction. It is necessary for each country to formulate a national TVET policy and establish a national training coordination structure and implementation bodies that will be able to manage the TVET policy and entire system. Actions to develop higher-level skills in technology and innovation are paramount for transforming national production systems and industrializing African economies (Kanwar et al., 2019).

African ministers of education and training helped articulate Africa's post-2015 education agenda submitted to and endorsed by the WEF and organized by UNESCO 2015, providing an additional 10 priority areas for the region: equitable and inclusive access for all; inclusion, equity, and gender equality; teachers and teaching; education quality and learning outcomes; science, technology, and skills development; education for sustainable development and global citizenship education; youth and adult literacy; skills and competencies for life and work; financing, governance, and partnerships; and education in crisis situations (AU, 2015).

E-Learning - Digital technologies, especially the possibility of online learning, offer the potential to vastly expand access to postsecondary education. From 2008 to 2018, about 15,000 new education apps and online technologies were created, accelerating the widespread adoption of digital education (AU, 2020). The World Bank's NESAP-ICT program has been trying to help countries with their online learning challenges. The New Economy Skills for Africa Program - ICT was launched in 2008 to support SSA countries in building skills for the knowledge economy (IFC, 2019). Case examples reveal digital learning initiatives to provide business and IT skills training free of charge to people and online communities offering more than 30 self-paced courses designed to help users develop business and IT skills in their own time and at their own pace (AU, 2020).

MOOCs, formal global network learning environments, provide partnered learning and connect learners, teachers, and communities in new ways of learning (Starke-Meyerring, 2010). With World Bank support, a new pilot initiative in Tanzania helps employers overcome the mismatch of skills in the local labor market and seeks to incorporate Coursera offerings as part of a broader initiative to help equip students with market-relevant IT skills. In Tanzania, NESAP-ICT is helping to support so-called SMART (Software, Mobile Applications, Research and Technology) skills development. A conference in Mauritius addressed new developments and outcomes of the United Nations Development Programme (UNDP) Millennium Development Goals representing Blackboard as a development opportunity to enhance e-learning for young adults. Another contributor covering local needs is Open University e-learning, an inspiration to certain African education authorities (Betchoo, 2017). In Ghana, to tackle the low number of African women in tech, Ivy Barley founded Developers in Vogue, an all-girls coding training program. Other examples programs contributing to women and girls in digital skill and literacy include.

Source: EU/Consiel Santé Digital4Women.

Gender, Health, and Wellbeing (Excluding Family Planning)

Reductions in armed conflicts have realized improvements in health, poverty, and living standards and increased access to communal education (OECD, 2018; UNDP, 2017). Yet, Africa's poverty

Table 1. Women and Girls Digital skill & Literacy Program, 2030

E-Education and E-Skills		
Initiative	Country	Description
SheSecures ¹⁴⁴	Nigeria	She Secures is an organisation based in Nigeria, for women professionals and enthusiasts in cyber security. They build awareness in cyber security and information security for women and girls of all ages.
Fempower Africa ¹⁴⁵	Across SSA	Fempower Africa is a social enterprise that seeks to train, teach and equip women in Africa with technology skills, leadership skills and entrepreneurship skills. Fempower Initiative Africa supports, inspires and empowers female founders both online and offline.
Coding for Employment Platform ¹⁴⁶	Across SSA	The African Development Bank and technology firm Microsoft launched in 2019 the Coding for Employment Platform, an online tool to provide digital skills to African youth, wherever they are across the continent.
The Virtual University of Senegal ¹⁴⁷	Senegal	The Virtual University of Senegal is the first public digital university in Africa, founded in 2013, combining e-learning with presence-based tutorials and networking. The e-learning platform and the laptops with mobile Internet connection provided by the University grant students a maximum of flexibility, which allows (self-) employed students, women with children, students living in rural areas and/or far from the capital to access higher education.
African Girls Can Code Initiative ¹⁴⁸	Across SSA	In collaboration with the African Union Commission, ITU and UN Women launched the African Girls Can Code Initiative (AGCCI) 2018-2022, which consists of a four-year programme to train and empower girls aged 17 to 20 years old with ICT skills.

level remains very high and the region is one of the most unequal in the world – 10 of its countries are listed among the 19 most unequal in the world. World Bank initiatives to expand opportunities that empower women include focus on legal rights and economic opportunities (Hallward-Driemeier and Hasan, 2012) to strengthen incentives and abilities to pursue property rights through policy, law and regulations and ensure enforcement through the Women’s Legal and Economic Empowerment Database for Africa (Women–LEED–Africa). The new database provides detailed indicators and links to statutes, constitutions, and international conventions on issues of legal capacity, marital property, land ownership, and labor law.

GSMA (2017) indicated that mobile phone ownership and usage (34%) represent a barrier for women, with higher hurdles to gaining access and meaningful use for women and girls with low education and low income. For example, Nigerian women (45%) who do not own a mobile phone reported literacy as a key barrier. Initiatives in place aim to increase the level of services being accessed; only about 25% of African women aged 15 and above had access to a formal financial account, compared to almost 33% of men (Demirgüç-Kunt et al., 2015). In South Africa, women are less generally likely than men to make mobile phone-enabled transactions, despite having formal financial accounts (OECD, 2018). Previous studies explain these gaps as related to social and cultural perceptions, with main contributors arguing that women are more likely to reject mobile banking since they are affected by social norms (peer influence) to a greater extent than men (see Garbarino and Strahilevitz, 2004; Laukkanen and Pasanen, 2008; Riquelme and Rios, 2010).

The Internet and digital platforms can help foster social wellbeing through connecting people and ideas, innovation, and relevant knowledge sharing, including relevant technologies and helping women access health care-related information, medical treatments, or prophylaxis, and reduce the risks and costs of early pregnancy (Billari, Ginutella and Stella, 2017). Moreover, mobile phones allow women to access relevant information, including on governmental support, election access, and pension rights (GSMA, 2013, 2016). Mobile phones enable digital access to help the collection of relevant data that could complement socioeconomic statistics needed to improve services. A survey of Kenyan women found M-PESA mobile banking accounts saw over three quarters of transactions occurring at least twice a week, with 95% indicating they sent money to their relatives. Women users (37%) owned a business, and 96% indicated M-PESA helped them scale their venture (Dubus and van Hove, 2017). As a result, an estimated 194 000 households have saved money more effectively and moved out of extreme poverty (Gates Foundation, 2017).

The Mobile Alliance for Maternal Action (MAMA) uses mobile phones in partnership with Vodacom Foundation to deliver vital health information to new and expectant mothers, supporting programmes in Africa, Bangladesh and India. Digital tools are designed with women's specific needs and priorities in mind, making them more likely to be used by women and to encourage women to use other online services (Cummings & O'Neil, 2015, p. 6). Unlocking the benefits of the DT can therefore transform the lives of many and offer leapfrog opportunities to women and girls in particular. Technologies used for connecting digital health and e-health services, social care, and wellness sectors offer solutions across the continent. In Kenya, mobile health technology is used to improve antiretroviral medication compliance by 11%. In Botswana, the deployment of a mobile-enabled programme reduced government response time to malaria outbreaks from four months to three minutes. Delivery of information and awareness via text message to young pregnant mothers in Mali helped to reduce perinatal and maternal mortality by 30% (OECD, 2018). Additional programs being deployed through sponsors' accelerator partners are examples of pharmaceutical multinationals providing mentoring and financial support to e-health start-ups in Africa. In Morocco, the Ministry of Health is implementing a promising pilot project to ensure better access to care for people in landlocked regions through the gradual deployment of telemedicine units in 160 isolated municipalities, representing 6.25% of the population by 2025. In Algeria, AQUINETIC offers solutions to visualize data on rare diseases data, AHMINI in Tunisia provides a simplified subscription to health insurance for rural women via mobile phone, and SUSU in Côte d'Ivoire is a platform offering healthcare packages to African diaspora upon repatriation. The Tanzanian Training Centre for International Health uses an audio teleconferencing model and an online e-learning platform to teach health workers and nurses about maternal and perinatal health care in rural areas (Stroetmann, 2018, 2019).

Rights, Governance, and Youth Empowerment

Rights and Governance

SDG 8 indicates key features of what constitutes a successful society and a vibrant African economy incorporating digital technology to improve life, wellbeing, and health, requiring grounded policies and approaches to include such values as human rights (SDG 8 targets) and for equity. Mobile-enabled digital ID tech identifies individuals through channels used in many areas related to registration, through digitalizing ID and using biometrics (fingerprint, iris, facial recognition, etc.) (AU, 2019). The benefits of a legal identity include gender equality, social protection delivery, financial inclusion, improved governance, safer migration, superior health delivery, enhanced and refugee child protection, reducing statelessness, and better access to land and property rights aligning with the UN Legal Identity Agenda 2020-2030 (Hanmer and Elefante, 2019; United Nations Legal Identity Agenda Task Force, 2020). Take up and usage must be enhanced by low cost, ease of use, and scalability (UNDP, 2017; WB, 2019c; WEF, 2020). Governance must promote joint action for e-services, e-transactions, data protection and privacy, cybercrime and consumer protection, health and non-health sectors, public and private actors, and citizens toward common interest and working to achieve DPP, OECD, UNDP and WEF policies and frameworks for Agenda 2063.

Governance/democratization focuses on outcome levels with emphasis on transparency, accountability, decision-making, and support for the rights of all citizens and empowerment across individual African countries and the continent. Governance policy at sector and cross-sector levels needs to be addressed to improve inequalities of gender and in communities (Hellström, 2010; Kaup Lapõnin, 2018). Reports indicate a few African countries have made progress in developing digital ID systems for legal ID and to exploit the digital economy. Given almost 25 years of ICT development on the continent, for many African countries' ICT readiness (infrastructure and access), use, and capability (skills) is still low but rising (AU, 2017; ITU, 2017).

Case examples of digital technology, ICT, and mobile initiatives include Kenya, based on partnerships, consultations with partner governments, policy, and implementation experiences with emphasis on mainstreaming and harmonization issues to emphasize civil society, donor agencies,

and private sector/software developer contributions. Digital technology initiatives also consider ICT for all types of governance themes, such as the rule of law and anti-corruption for SDG initiatives (Auriacombe and Vyas-Doorgapersad, 2019).

Youth Empowerment and Advocacy

The Youth Inclusion Project, co-funded by the European Union and implemented by the OECD, supports African countries (Côte d'Ivoire, Ethiopia, Malawi, and Togo, amongst others) in better responding to the aspirations of young people and strengthening youth involvement in national development processes. A number of activities are carried out at the country level, including the publication of a youth wellbeing policy review, national workshops with key stakeholders to foster policy dialogue on youth inclusion, and training activities to strengthen the capacities of national policymakers in designing evidence-based policies that promote youth inclusion and wellbeing (OECD and Africa, 2015; AUC/OECD 2021).

The youth in Africa are far more active on social media and digital platforms than their older counterparts are. The rise of social movements also shows that young people may use other civic channels to act on what they care about (World Bank Group, 2018). Young women participate less in public affairs compared to their male counterparts and report significantly less interest in public affairs and discussions around them (Das and Espinoza, 2019). The Internet affords anonymity, allowing groups that would otherwise not have a voice to express themselves through online media. An example case in South Africa highlights a student-led Fees Must Fall movement; although young people may not participate in formal political processes, they are nevertheless politically very vibrant (Das and Espinoza 2019). Youth advocacy for empowerment can be used to address imbalances, inequities, and disparities, to promote human rights, social justice, and a healthy environment, and to further opportunities for democracy by promoting children's, youths', and women's participation using technologies such as email, websites, blogs, podcasts, text messages, Facebook, and Twitter to reach a large audience and enable fast communication (UNICEF, 2010).

Agriculture, Climate Change, and the Environment

E-Agriculture

In the area of agriculture, in-farm production and off-farm processes are projected to have continued growth with the potential of 41 million jobs over the next 10 years, uplifting low-skilled men and women farmers in rural communities and building connectivity to information and markets (AfDB, 2014; WB, 2019a). The Digital Development Partnership (WB, 2019d) is assisting with development of an economic framework to apply disruptive technologies in agriculture to enable farmers and agribusiness entrepreneurs to accelerate current methods to increase productivity, efficiency, and competitiveness, facilitating access to markets, improving nutritional outcomes, and enhancing resilience to climate change (WB, 2019b, AUC/OECD 2021).

Agri-tech solutions that increase competitiveness along the value chain and sustainability of agricultural transition range from mobile apps and solar applications to portable agriculture devices and biofortified foods, to sensors/IoT and blockchain in an evidence-based way (WB, 2019c). A toolkit developed jointly by the World Bank's Agriculture Global Practice and the Digital Development Global Practice serves as a blueprint for a new generation of digital agriculture lending projects (WB, 2019c). One example is an SMS network for farmers who are working with agricultural extension officers. The network allows many-to-many, mediated, conversations—a quantum improvement over the one-way communication of a government official telling farmers what to do.

In Ghana, agri-tech firms like Farmable, Farmerline, and Esoko have successfully pursued the creation of new business ventures and renewal of existing, matured corporate business models. Supporting farmers with pricing data, crowdfunding, and communication activities, these agri-tech firms are also connecting farmers with buyers and helping them determine what differentiates them

from competitors. Digital technologies are playing a role in Nigeria's agricultural sector too. Prime Wave, an engineering company that supplies equipment to rice processing firms, and Al-Wabel Trading Company Ltd, a rice miller, have been collaborating to invent new technological solutions aimed at improving performance in rice processing. However, these firms have had to overcome regulatory and institutional challenges in the sector. Launched in 2014, Kenya's Twiga foods uses a technology platform to improve the supply chain from farmers to markets and serves around 2,000 outlets a day through a network of 13,000 farmers and 6,000 vendors. The company has reduced typical post-harvest losses in Kenya from 30% to 4% for produce brought to market on the Twiga network (WB, 2019b).

In Botswana, the Naledi Magowe initiative created the mobile agriculture app mAgri giving farmers access to information, markets, low-cost communication, and short-term finance (WSIS and ITU, 2018). mAgri allows farmers to market their products and services across the country, using any cell phone, and from any part of Botswana, advancing SDGs 1, 2, 6, and 8. In Chad, the Association of Technicians in Information and Communication Technology created a program providing farmers with ICTs, to aid them in gaining information on their activities (SDGs 1 and 2). The project's overall objectives are to: introduce agriculture to new devices for the use of ICT; sensitize and train young people on the challenges of rural and agricultural development in Chad through ICTs; and modernize the agricultural production system through ICTs to provide farmers with practical means for the progressive reduction of poverty and the digital divide. In March 2008, the Government of Ghana and the WB launched the West Africa Agriculture Productivity Program. One project under the Ministry of Food and Agriculture piloted an electronic extension of agriculture technical services to farmers and other stakeholders in the agriculture sector using a web portal, call centre facility, and interactive voice response system to assist farmers. This model is relevant to SDGs 1, 2, 3, 4, 5, 6, 7, 8, 12, 13, 14, and 16 (WSIS and ITU 2018).

Climate Change and the Environment

Reducing extreme weather events such as cyclones and heatwaves due to increased industrial emissions and deforestation increasing carbon dioxide requires climate change initiatives at international, national, regional, and local levels (UNICEF, 2019). WSIS and ITU (2018) provide several case examples and their alignment with SDG initiatives. On digital technologies relating to the Africa, Asia, and Pacific regions, the international Mobilizing Arab-Wide Action for Reliable Environmental Data (MAWARED) is an online platform allowing users to upload their environmental observations to a central server using smartphones. All observations are shown directly on an interactive web mapping system. The application promotes wellbeing and contributes to safety of cities, sustainable use of oceans, and the fight against desertification (SDGs 3, 11, 13, 14, 15, and 17). In Kenya, the Hydrologistics Africa Company developed the project HydroIQ, the world's first virtual water network operator, in line with SDGs 6, 9, and 11. HydroIQ is a smart metering device plugged into the existing water supply network, turning the traditional water system into a smart water grid. In Nigeria, the African Youth Movement, in partnership with Van Dijk Water Management B.V. Netherlands, initiated the program Nigeria Water Information System. The database tracks water loss through leakages as well as extortion, corrupt practices, and illegal connectivity. The messaging app has a user-friendly interface rural dwellers can use to send SMSs for broken pipes in the Bwari Area Council Territory. This project advances SDGs 1, 3, 9, 11, 13, and 14. The Ghana National Cleaner Production Centre implemented a project on electronic waste and developed the Ghana e-waste model that formed a basis for the 2016 Hazardous and Electronic Waste Control and Management Act. This led to the government setting up an e-waste recycling plant at Agbogbloshie. This project is instrumental in achieving SDGs 3, 6, 7, 8, 9, 11, 12, and 14.

Table 2. Example of Digital Farming Start-Ups Across Africa

Start-up	Country	Region	Established	Description
Zenvus	Nigeria	West Africa	2016	Provides intelligent solution for farms that uses proprietary electronics sensors to collect soil data like moisture, nutrients, pH etc. and send them to a cloud server via GSM, satellite or Wifi. Algorithms in the server analyze the data and advice farmers on farming. As the crops grow, the system deploys special cameras to build vegetation.
TroTro Tractor tech	SENEGAL, Ghana,	West Africa	2016	The app offers a platform that allows you to track suitable commercial vehicles / equipment on demand. With etrack, receive instant notifications and follow your vehicles in real time.
Kitovu	Ghana, Benin, Senegal, Kenya, Cote d'Ivoire	West Africa	2018	The Kitovu platform collects soil and market demand data. The soil data enables us to provide farmers with soil and crop specific fertilizers, as well as certified seeds and agrochemicals; which when combined with agribusiness practices successfully triples crop yields.
ThriveAgric	Nigeria	West Africa	2016	an agricultural technology startup providing access to finance, premium markets and data driven advisory for smallholder farmers.
Farmcrowdy	Nigeria	West Africa	2016	a global Agtech company focused on helping stakeholders in the food value chain maximize their output and increase their profits with technology.
Wefarm	Uganda, Kenya, Tanzania	East Africa	2018	Enables small-scale farmers connections to other to solve problems, share ideas and spread innovation. User base is over 1 Million in Kenya and Uganda.
Promagric	Cameroon	Central Africa	2016	Helps farmers combat crop disease to reduce agricultural losses. Its tech apps use Artificial Intelligence to diagnose crop disease from images.
Areobotics	South Africa	Southern Africa	2014	It provide aerial imagery from drone and satellites to provide early problem detection services to tree and wine farmers to optimize crop performance.
Farmerline	Ghana	West Africa	2012	Provides small-scale farmers with mobile access to agricultural services. It reaches over 200 000 farmers in ten African countries.
AgriEdge	Morocco	North Africa	2018	It deploys weather data and satellite and drone imagery for precision farming, it reaches 30 000 farmers in five African countries.

Source: Authors' Compilation

Telecommunication and Infrastructure

Telecommunication

Submarine cables and landing stations play an essential role in reducing the digital divide between Africa and the rest of the world. Previous connectivity across Africa was carried out through SAT3 cables. The continent's countries and players (operators, ISP providers) have, through satellite stations, over 70 submarine stations operated by 8 different consortiums/investors (SAT3, ACE, GLO, EASSY, SEACOM, WACS, MainOne, TEAMS). Africa connects directly with South America, offering alternative, lower-latency routes to the Americas through the South Atlantic Cable System (SACS). Cases include Hurricane Electric undersea cables into the Kenyan market by operating a point of presence in Nairobi, allowing service providers to buy international capacity (transit) from them directly without having to purchase both terrestrial and international transit. South Atlantic Cable System (SACS) are able to establish a point of presence by trading capacity on their international networks with African network operators (Song, 2020). Case projects include high-throughput satellites (HTSs) capable of delivering modern broadband speeds at realistic prices for ISPs. HTS launches in 2019, such as Spacecom's Amos 17 and Eutelsat's KonnectAfrica, have had real impact on the continent's rural Internet service delivery (Song, 2020;).

Additionally, licensed digital dividend spectrums (700MHz and 800MHz) for mobile broadband have been realized across a number of African countries. In Ghana's 800MHz auction where MTN paid \$67.5 million for 20MHz (2x10MHz) of spectrum, Vodafone acquired \$30 million in spectrum for 10MHz. In Tanzania, a successful spectrum auction was held in the 700MHz band, with two operators (Vodacom Tanzania and Azam Telecom) winning licenses for 20MHz (2x10MHz) for \$10 million each. In Mozambique, the regulator received bids for an 800MHz spectrum. Three of the five

10MHz (2x5MHz) lots were successfully auctioned at \$15 million to Mcel, Vodacom, and Movitel. In Kenya, the regulator has chosen not to use spectrum auctions; alternative plans for the 700MHz band saw the regulator divide the band into three lots 30MHz (2x15MHz). Jamii Telecom was given a trial license by the regulator, encouraging second-tier service providers to form consortia and pay a \$25 million fee. Cases for unlicensed and dynamic spectrum or television white spaces (TVWS) have seen several big leaps forward on the continent. In South Africa, regulators formally gazetted rules for the use of TVWS in the country. In Mozambique substantial moves were made toward TVWS regulation, partnering with Nominet, the UK internet registry that developed a TVWS geolocation database (Song, 2020;). These projects align with SDGs 4, 8,9, 12, and 17 (UNDP, 2017).

Infrastructure

ICT infrastructure, access, use, and skill have been implemented across African countries for over 30 years at a broadband infrastructure cost totaling over \$5.5 billion in investments. But the continent still lags behind the rest of the world, especially emerging Asian economies (WB, 2020b). Current mobile infrastructure, networks, and mobile devices are increasingly being used to access an array of life-enhancing services that contribute to and catalyse achievements related to SDG 9 (Industry, Innovation and Infrastructure), which remains the most impactful goal to spur inclusiveness, sustainable development, and greater innovation. In addition, mobile, with its half a billion unique mobile subscribers, has had an enormous impact on financial inclusion, cutting across multiple SDGs, including SDGs 1, 2, 3, 8, and 10. Four of the most populated markets in the region (D.R. Congo, Ethiopia, Nigeria, and Tanzania) will account for nearly half of the 115 million new subscribers expected by 2020 (WSIS and ITU, 2018 GSMA, 2017, 2020).

Infrastructure enablers have grown dynamically, fueled by expanded 4G coverage and mobile broadband coverage in Africa. Network quality has also improved substantially; the vast majority of countries now have average broadband speeds that allow reasonable-quality Internet browsing (greater than 2Mbps). Mobile Internet access, particularly for the poorest 20% of communities, experiences regional barriers, and while data has become more affordable, mobile devices remain out of reach with penetration rates at 45%, much less than in other regions of the world (GSMA, 2020). In Benin, the ISOCCEL initiative launched Cotonou's buggiest WiFi Network to deliver direct Internet connection to end users with WiFi-enabled devices. Meeting SDG targets will impact sustainable industrialization, inclusive and sustainable economic growth, employment and decent work for all, the building of resilient infrastructure, the development of inclusive, safe, resilient, and sustainable cities, and revitalization of the global partnership for sustainable development. In Cote d'Ivoire, the LIFI LED project enables access to high-speed Internet (3Gbps, 30 times faster than WiFi) taking the light from LED bulbs (renewable energy). The project is a green technology (ecological) project and promotes sustainable development as it uses visible light to transmit information rather than electromagnetic waves such as WiFi. It supports advancement of SDGs 1, 3, 4, 7, 10, 13, and 17. In Mali, operators implemented more than 6,000km of optical fibre and the Government has installed over 3,000 km of optical fibre. This will allow the country to be connected in broadband with four of its seven neighbours — Burkina Faso, Cote d'Ivoire, Mauritania, and Senegal (SDGs 4, 8, 9, 12, and 17). Table 2. Examples of Digital starts-up, accelerators and Telecommunication &Infrastructure layers forming the Africa's digital ecosystem, 2021.

Source: Adapted Crunchbase.com dataset- Replicated from OECD <https://doi.org/10.1787/0a5c9314-en>.

Opportunities and Challenges: Frameworks, Models, and/ or Roadmap for Digital Transformation

Realization of African countries' DT potential requires the continuation and reconfiguration of structural reforms, further innovation and investment, and widespread adoption of a digital ecosystem that gives rise to cluster technology providers and partnering organizations offering value chain

Table 3. African Digital Starts-Ups in Telecommunication and Infrastructure.

Telecommunication and Infrastructure					
Digital Impact	Company Name	Established Yr.	Main Activity	Location in City	Country
Digital Economy	OPay	2018	FinTech	Lagos	Nigeria
	Interswitch	2002	Fintech	Lagos	Nigeria
	Cellulant	2004	Fintech	Nairobi	Kenya
	Fawry	2008	Fintech	Cairo	Egypt
	JUMO	2014	Fintech	Cape Town	South Africa
Digitalised economy	M-KOPA	2011	Energy	Nairobi	Kenya
	Twiga Food	2013	Business-to-Business e-commerce	Nairobi	Kenya
	Jumia Group	2012	E-commerce	Lagos	Nigeria
	Kobo360	2018	Logistics	Lagos	Nigeria
	Takealot.com	2011	E-commerce	Cape Town	South Africa
Start-up/ accelerator	Raye7	2016	Ride Sharing	Cairo	Egypt
	Naspers	1915	ICT investment	Cape Town	South Africa
	Co-Creation Hub	2010	Start-up incubation	Lagos	Nigeria
	Flat6Labs	2011	Early Stage Ventures and Seed Funds	Cairo	Egypt
	Sensor Networks	2015	Software and IT consulting	Cape Town	South Africa
Core IT and Digital sector	Mara Phones	2018	Hardware Manufacturing	Kigali	Rwanda
	Aerobotics	2014	Software and IT Consulting	Cape Town	South Africa
	Orange	1988	Telecoms	Casablanca HQ	Morocco
	MTN Group	1994	Telecoms	Johannesburg	South Africa
	Safaricom	1997	Telecoms	Nairobi	Kenya

services: venture capital, mentoring, co-venturing, etc. Until these come into play, existing marginal contributions to the continent's digital ecosystem will remain. In this paper, the deployment of digital technologies have been broadly grouped into six substantive categories to determine optimization within the digital ecosystem, related market penetration, and transactions across African societies. The nexus of digital assets forming a part of the cluster organization are artificial intelligence, machine learning, Big Data, analytics, IoT, biotech, and nano- and microtech for satellite, health, 3D printing, and robotics, amongst other emerging digital technologies. Table 3. Examples, digital entrepreneurs forming the backbone to the African ecosystem.

Table 4. Entrepreneurs forming the backbone of African ecosystem.

Opportunities and Challenges: Frameworks, Models, and/or Roadmap for Digital Transformation						
Company name	Established Yr.	Service Description	Regions / Countries of Operations	Business Model Focus	Market Segment	Value proposition
Mpost	2016	Mpost converts phone numbers into formal postal addresses, receipt for goods	Kenya Botswana, Rwanda, Tanzania and Uganda.	Mobile Postal Services	Postal services – "communal addresses"	"Communal Addresses" in Africa need eliminating
Pargo	2014	Delivery platform "click-and-collect" to help retailers sell and deliver goods to their customers using collection points of their choice.	Botswana, Eswatini, Lesotho, Namibia and South Africa	Logistics and delivery online platform	Logistics services for informal settlements and rural areas	Helps retailers solve challenges of last mile-delivery
SpacePointe	2014	A Global financial technology company offering digital payment services to MSMEs in the informal sector and rural areas	West Africa, North America, and Asia	Cloud-based payment platform	Electronic payment collection for the informal sectors and rural areas	Drives the adoption of electronic payments by the informal sector
Eteyelo	2015	They develop apps allowing schools monitoring, management of fees and parent-school relationships.	DRC	Mobile apps and web platform	Digital data services for education systems	Reduces the distance between all actors in the education system (Students, teachers and parents, etc.)
SWVL	2017	They offer an app that allows users to book fixed –rate affordable rides on its network of vans and buses.	Egypt, Kenya and expansions in Nigeria	Mobile platform for bus sharing	Smart mobility services in urban areas	Facilitates mobility in urban areas and helps reduce traffic congestion

Source: OECD Africa's Development Dynamic2021; <https://doi.org/10.1787/0a5c9314-en>

To leverage the opportunities of digital technologies, international organizations have outlined specific plans of action for people, planet, and prosperity. These follow the UNDP 2030 Agenda, AfDB Group, and the African Union Development Agency-NEPAD (AUDA-NEPAD), incorporating the UN's SDGs, and AU Agenda 2063 along with those of nation states' Nationally Determined Contributions Plans, aligning with the Paris Agreement. Consideration of the UN's SDG agenda highlights the need to assist developing countries in attaining long-term debt sustainability through coordinated policies aimed at fostering debt financing, debt relief, debt restructuring, and sound debt management, as appropriate. Many countries remain vulnerable to previous debt crises (UNDP, 2017; WB, 2019c) and are now also in the midst of upheavals caused by the COVID-19 pandemic.

African countries are leveraging global research collaborations and partnerships such as with BFA Global to intersect critical sectors with technical cooperation. The case of Microsoft South Africa and Afrika Tikkun technical cooperation provided \$150,000 in grants to bring new digital skills to underserved populations and reskill workers impacted by COVID-19 (Andrews and de Montesquiou, 2021; Microsoft News Centre, 2021, AUC/OECD 2021). Regarding integrated planning in African countries, least-developed countries, landlocked developing countries, and small-island developing states build upon global, national, and regional level as well as the High-level Political Forum on sustainability development conferences and reviews of all relevant UN conferences and processes that promote regional economic integration and interconnectivity. All information is mapped to a partner online platform and serves as the main source of information access, knowledge, and experience for African countries, international agencies, and partners. The SDG index report (SDG Center for Africa and Sustainable Development Solutions Network, 2019) explains that nearly half of the 169 SDG targets are not quantified and only 40% of the indicators in the Global SDG framework have data. Some indicator data collection has not yet materialized, and some indicator methodology is still undefined. The data gaps are due to only four countries having managed to host a separate, standalone website for the SDGs: Gabon, Kenya, Morocco, and Nigeria. Botswana, Libya, Mauritius, Namibia, Uganda, and Zambia reported that an SDG web page exists on the coordinating ministry's website; in some of the countries, the data is particularly egregious. Out of all these countries, Botswana, Libya, and Nigeria are the only countries that update their SDG-related websites regularly. The common challenges are technical capacity, data collection and processing, and the adoption and application of international statistical standards and new technologies (SDG Center for Africa and Sustainable Development Solutions Network, 2019). African governments and regional agencies are formulating implementation strategies through environmental and cultural shifts to create space for international, regional, and locally available digital initiatives to work at achieving SDG goals.

FINDINGS

The paper finds that the digital technologies that align with SDG initiatives focus on items indicated in SDG 17: Strengthen the means of implementation and revitalize the global partnership for sustainable development through finance, technology, capacity building, trade, and systemic issues of policy and institutional coherence, multi-stakeholder partnerships, and data, monitoring, and accountability (GRI, UN Global Compact, and WBCSD, 2015). The eight substantive categories explain the progression of the digital landscape presented through multiple countries' and sectors' digital technology through case examples of deployment, experimentation, and implementation.

CONCLUSION

The landscape of activities faces policy constraints due to policies having differential implications for different stakeholders — African governments, the private sector in Africa, regional bodies in Africa, external agencies and NEP governments, and business partnerships underline that other social,

political, or economic leverage and unofficial actions are detrimental to advancing the African digital agenda 2030 and 2065 priorities (EU-AU, 2018; OECD, 2020; UNCTAD, 2019). See Africa's key continental strategies/Programmes in Annex A1 and 2063 flagship programmes A2

RESEARCH LIMITATIONS

For this research, a decision was made to select articles, white papers, policy documents, roadmaps, and guidance notes pertaining to African DT. The implications are that the analysis synthesizes currently available literature. This also contributes towards the research study's limitations as previous articles may have provided additional information on parties' thoughts and ideas on the challenges in and opportunities for working towards advancing and fulfilling the SDG initiatives.

PRACTICAL IMPLICATIONS

Research with considerable content spanning multiple global institutions, partners, and agencies presents difficulties in accessing data and communication messages that provide consistency in understanding across all domains associated with the subject matter. Information and information access are further complications, and the verification procedure and next-level access are lengthy processes that also complicate the synthesis of primary research data. Non-familiarization with and the variation of organizations' search systems have additional practical implications.

ORIGINALITY/VALUE

Research spanning several years of enquiry and varied categories across multiple subjects from multiple global organizations can present difficulties in synthesizing the subject matter ideas. Here, the research is organized across categories and themes, resulting in a better understanding of the compiled effect of initiatives and the aligned goals that are to be achieved. This paper provides a framework for readers to determine the experiments, actions, and implementations of DT across the main economic pillars mentioned through the main documents underpinning research on this continent and subject domain. Manager in contributing firm, potential partners can use this knowledge on SDG guidance and objectives to achieve across digital Africa.

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APPENDIX A - AFRICA'S KEY CONTINENTAL STRATEGIES/PROGRAMMES (1)

Table 5. Africa Digital Transformation Strategy alignment to SDG2030 & Goals 2065

Annex A1. Africa's key continental strategies/Programmes (1)				
Digital initiatives	Launch/ Attainment dates	Stakeholders/ Actors and Agents	Objectives to Achieve	Digital Impact Areas(DIA)
Digital Transformation strategies for Africa	2020-30	AFDB AUC UNECA AUDA-NEPAD AFDB ITC EIB	Using digital technology and Innovation to transform African societies and aiding economic growth will promote African integration, raise inclusiveness, stimulate jobs, improve access to health to impact all areas of the <u>continent's</u> socio-economics landscape	<ul style="list-style-type: none"> Promoting Africa digital economic financing working principles and tools. Universal access to affordable connectivity. Harmonising policy, Legislation and regulation, Network and service upgrades. Identity for 99.9% of African to achieve civil registration. Accessible, usable Digital solutions across main economic sectors.
Policy and Regulation Initiative for Digital Africa (PRIDA)	2018-22	AUC European Commission ITU	<ul style="list-style-type: none"> Efficient and <u>harmonised</u> spectrum <u>utilisation</u> Harmonisation of measurable ICT/Telecommunications policy, legal and regulatory frameworks African decision makers' active participation in the global internet governance debate Capacity of African stakeholders for active participation in the global internet governance is improved. 	<ul style="list-style-type: none"> Cross continental position on internet governance. PRIDA Platform formation/ usage Objective achieved using regulated and <u>harmonised</u> digital tools and platforms.
Cybersecurity	2014	AUC	Provide guidance and recommendations on Cyber policies and strategies to AU with the aim to adopt, monitor, prevent, mitigate and address current and emerging cyber threats and data misuse.	<ul style="list-style-type: none"> Adopt the Malabo Convention on Cyber Security and Personal Data Protection. Provide fundamental principles and guidelines. Ensure an effective protection of personal data. Create a safe digital environment for citizens, security and privacy of individuals' data online.
Digital ID Blueprint for Africa	2019-21	Smart Africa OGV – Accenture Verrakis, UNECA Au Member States	helping African citizens participate in the economy and feel a sense of inclusion.	<ul style="list-style-type: none"> SMART Africa Trust Alliance Roadmap Field-testing and country alignment Pan-African Trust Framework Digital ID implementation plans Digital single market
Dot Africa	2017	AUC Registry Africa	African domain identified internet assets for web users and business across the continent	African domain service for continent focused users and businesses
African Outer Space Programme	2016	AUC	To create a well-coordinated and integrated continental programme, building both ground and space infrastructure tailored to all sectors.	<ul style="list-style-type: none"> Technology and tailored services for food security and disease prevention and catalogues on disease. Location-base mobile services, mapping of E-government strategy. Spatial information on key infrastructure, such as for transport, energy sources and power system, and distribution networks to support PIDA.
Digital Economy for Africa initiative(DE4A)	2020-30	AUC World Bank	The DE4A aims to ensure that every individual, business and government in Africa is digitally connected by target date	<ul style="list-style-type: none"> Universal, affordable and good quality broadband access by 2030 At least 250 000 km of fibre across the

Source: UNESCWA.org-LAS joint workshop on Developing the African digital agenda.

APPENDIX B - AU AGENDA 2063 FLAGSHIP PROGRAMMES (2) AND PRIORITY PROGRAMMES CONTRIBUTING TO DIGITALISATION AND JOB CREATION IN AFRICA

Table 6. AU Agenda 2063 flagship and priority programmes for African digital job creation.

Annex A2. AU Agenda 2063 flagship programmes (2) and priority programmes contributing to digitalisation and job creation in Africa				
Strategies/ Initiatives	Launch/ Attainment dates	Stakeholders/ Actors and Agents	Objectives to Achieve	Digital Impact Areas(DIA)
Programme for Infrastructure Development in Africa (PIDA) - Phase 1 and 2	Medium term: 2021-30 Long term: 2031-40	AfDB AUC UNECA AUDA-NEPAD AfDB ITC EIB	PIDA is the key strategic framework for the development of world-class regional infrastructure, of which four of the flagship programmes of Agenda 2063 are included, centred on the provision of digital infrastructure.	<ul style="list-style-type: none"> Strategic framework for the development of regional and continental infrastructure in energy, transport, ICT and transboundary water resources Power transmissions constructed, built or upgraded
African Continental Free Trade Area (AfCFTA)	Launched in 2019	AUC RECs	AfCFTA aims to achieve a single continental market for goods and services by 2030.	<ul style="list-style-type: none"> AfCFTA e-commerce protocol AUC African e-commerce start-ups web-portal platform Africa e-commerce platform Postal e-commerce platform Strong production and manufacturing networks
African Union Financial Institutions	2014-34	AUC African Association of Central Banks (AACB) African Securities Exchanges Association (ASEA) Afreximbank	The Initiative aims at mobilizing domestic and external resources and promoting African monetary co-operation to accelerate economic integration and socio-economic development of the continent.	<ul style="list-style-type: none"> Financial integration and inclusion through the development of fintech in Africa Establishment of virtual Pan-Africa Stock Exchange
African commodities Strategy	2020-20	AUC	The strategy aims to use commodity-led industrialisation as driver for achieving the structural social and economic transformation of Africa	<ul style="list-style-type: none"> Digitalisation of commodity markets Digitalisation of factors of production Digitalisation of research and development tools
Science, Technology and Innovation Strategy for Africa 2024 (STISA-2024)	2014-24	AUC	STISA-2024 supports Africa's transition to an innovation-led, knowledge-based economy within the overall framework of the AU Agenda 2063.	<ul style="list-style-type: none"> Online e-skills development programme on basic knowledge and skills in digital security and privacy to 300 million per year by 2025 Digital app on motivating girls from dropping out of schools E-platform for promoting education for African girls and women through networking, knowledge sharing and responsibility Development of tele-health apps, agricultural industrial chains, environmental data platforms and space infrastructure and applications
Decade Plan of action for TVET and Youth Employment	2019-28	AUC	The plan articulated actions that will guide and influence reforms and development of technical and vocational education and training(TVET) in Africa including meeting the existing and future labour market demand over the next ten years.	<ul style="list-style-type: none"> The use of digital technology to enhance teaching, learning and assessment
Continental Strategy for Technical and Vocational Education and Training(TVET Strategy)	Launched in 2015	AUC	The TVET Strategy provides a strategic framework for the development of national policies to address the inherent challenges in TVET including governance, relevance, innovation and creativity, and employability.	<ul style="list-style-type: none"> Training for adaption and use of appropriate technologies to facilitate youth employment and employability
Pan African e-network	Launched in 2009	AUC Government of India Data Center at the Telecommunications Consulting of India Limited	The Pan African e-Network aims to connect African Union members states to India through a satellite and fiber-optic network.	<ul style="list-style-type: none"> Capacity building and sharing of experiences of e-services and tele services
African Virtual and E-university	Launched in 2019	AUC	The university aims to accelerate the development of human capital, science and technology, and innovation through increased access to tertiary and continuing education in Africa by capitalising on the digital revolution and global knowledge	<ul style="list-style-type: none"> Launch of virtual higher education courses through the pan-African university digital platform

Source: OECD Africa's Development Dynamic 2021

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